DEC 7 1939

Heating · Piping and Air Conditioning

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DUSTRY AND
BUILDINGS

MBER, 1939

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—Journal Section of
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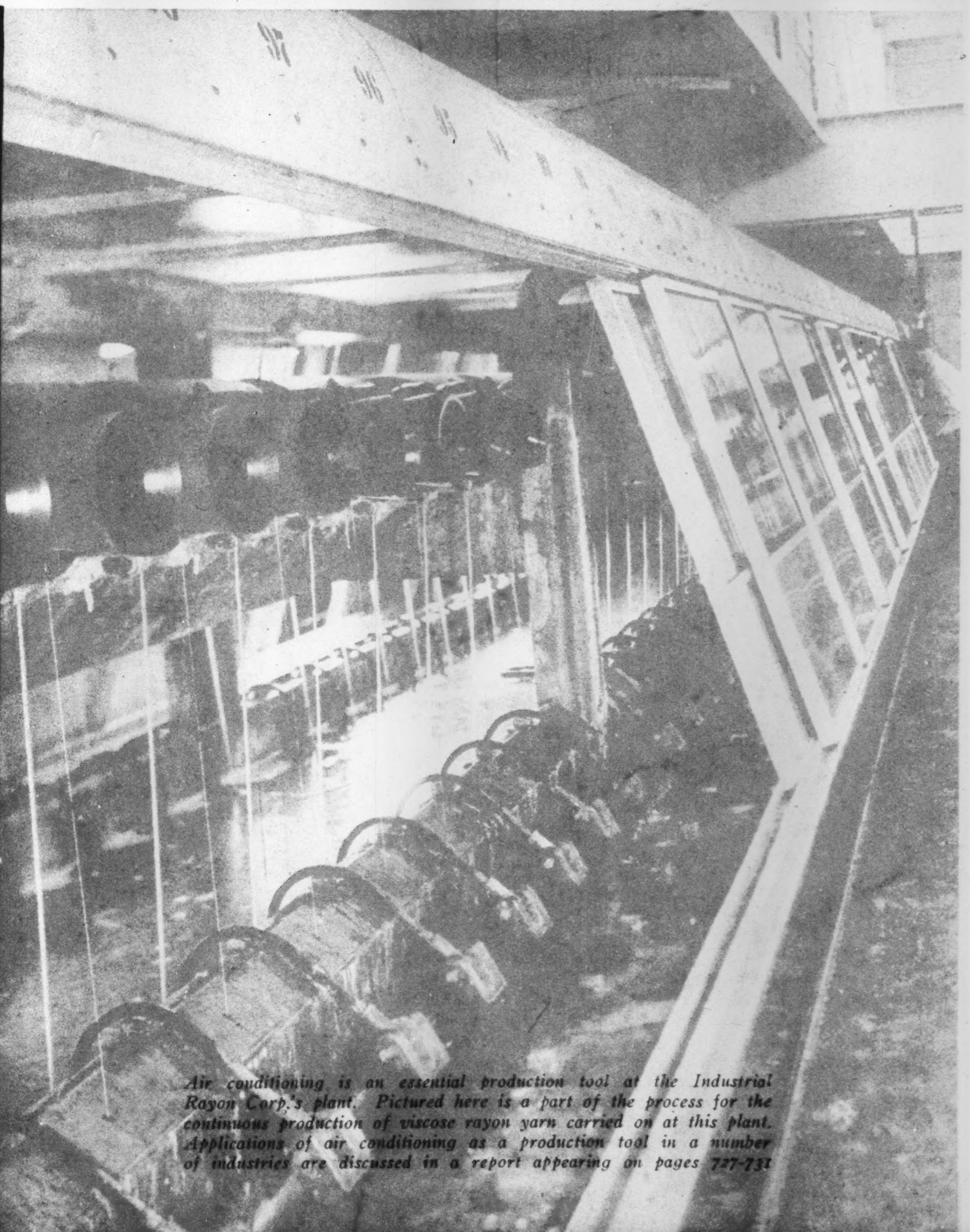
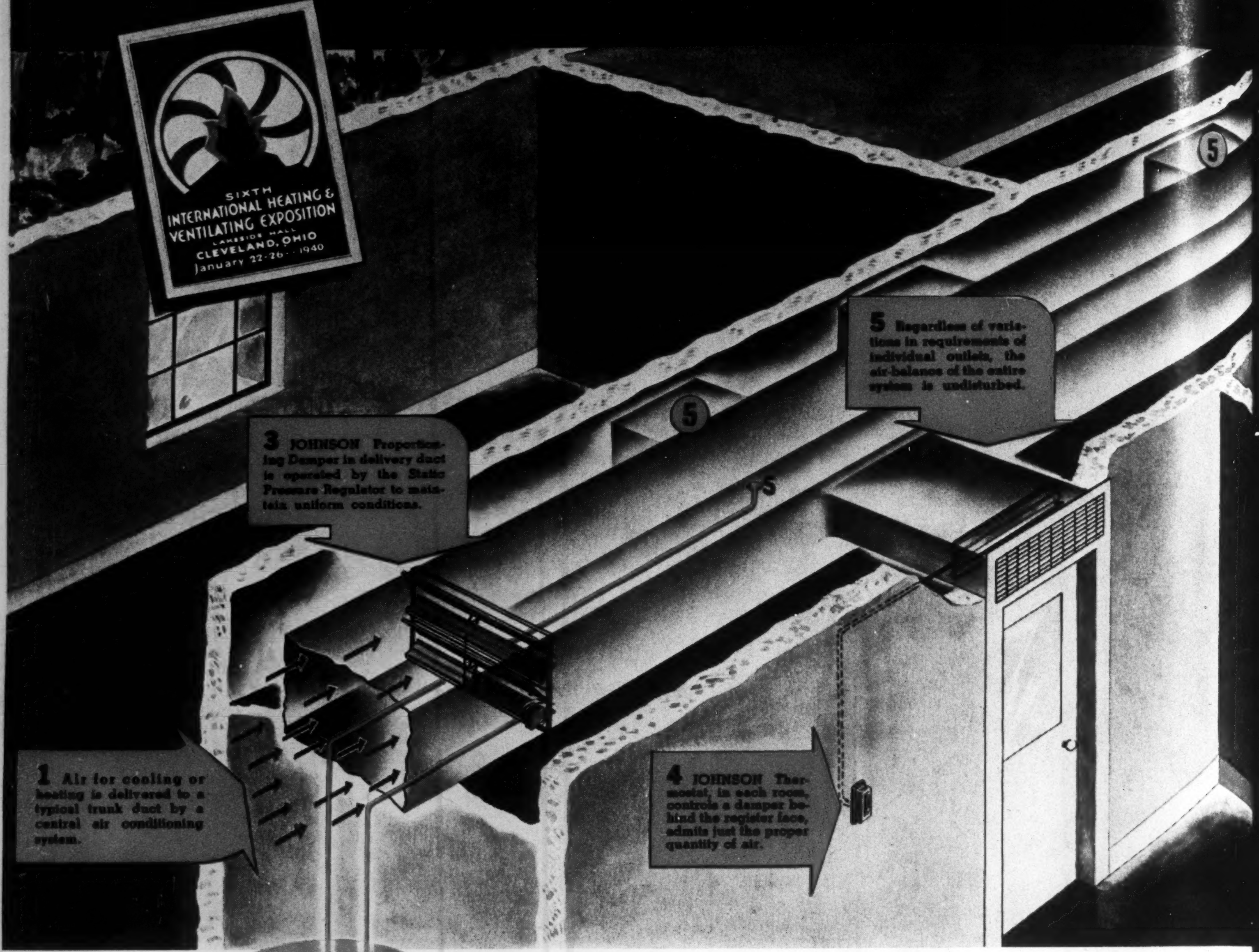


Air conditioning is an essential production tool at the Industrial Rayon Corp.'s plant. Pictured here is a part of the process for the continuous production of viscose rayon yarn carried on at this plant. Applications of air conditioning as a production tool in a number of industries are discussed in a report appearing on pages 727-731

Maintain *Constant Static Pressure* in Delivery Duc

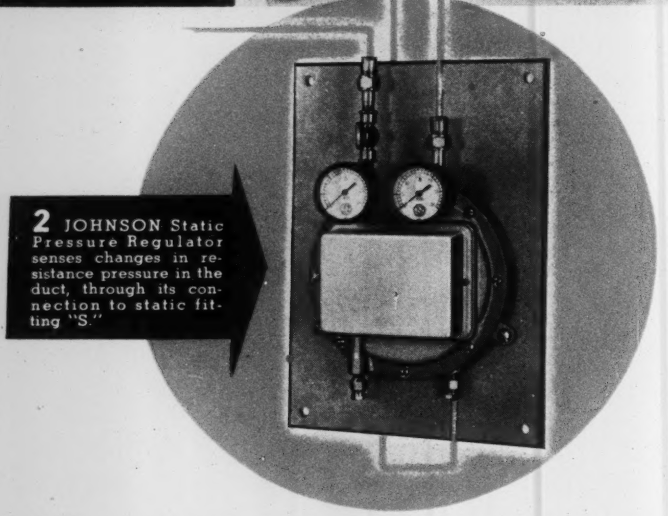


3 JOHNSON Proportioning Damper in delivery duct is operated by the Static Pressure Regulator to maintain uniform conditions.

5 Regardless of variations in requirements of individual outlets, the air-balance of the entire system is undisturbed.

1 Air for cooling or heating is delivered to a typical trunk duct by a central air conditioning system.

4 JOHNSON Thermostat, in each room, controls a damper behind the register face, admits just the proper quantity of air.



2 JOHNSON Static Pressure Regulator senses changes in resistance pressure in the duct, through its connection to static fitting "S."

with JOHNSON
Static Pressure Regulat

Now, the problem of maintaining proper balance of con
tions in a trunk duct is solved! No longer is it necessary
upset the entire air delivery system when dampers in in
vidual outlets are operated, automatically or manually,
satisfy the temperature requirements of certain rooms .
The JOHNSON Static Pressure Regulator senses just w
is happening, all the way down the line. The exact re
tance pressure, at which the system was balanced, and
which "splitters" were set, is maintained automatica
Johnson's *Adjustable Sensitivity* tunes the Regulator
fit the exact requirements of the particular installation.

The JOHNSON Static Pressure Regulator is only one of many interesting Johnson developments that solve automatic control problems for the air conditioning industry. Johnson *Modulating Attachments* for thermostatic expansion valves, Johnson *Adjustable Sensitivity* thermostats, Johnson *Pilot Operated* valves and damper motors are equally valuable. Send for bulletins. Ask a Johnson engineer for further details.

JOHNSON CONTROL • THE BRAIN OF THE AIR CONDITIONING SYSTE

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THE EDITOR'S PAGE

COMING YEAR IS PROMISING

A 42 per cent increase in orders booked during the five month period from June 1 to November 1, 1939, over those of the same period in 1938 has been reported by William S. Shipley, president of the York Ice Machinery Corp. During the 1939 period, orders booked totaled $6,501,499 against $4,576,831 for the same 1938 period.

"This increase is in line with general business conditions. Our volume was 18 per cent greater than for the same period in 1937 and if this is any indication of what we can expect in the near future, the coming year should hold real promise," Mr. Shipley stated. "It is interesting to note," he added, "that the month of October this year was practically equal to October, 1936, which produced the largest volume of any October in the past nine years."

GENERAL ELECTRIC ELECTS NEW EXECUTIVES

Charles E. Wilson, executive vice-president, was elected president and Philip D. Reed, assistant to the president, was elected chairman of the board of directors of the General Electric Co. at the meeting of the directors of the company in New York City, November 17. They will take over their new responsibilities January 1, succeeding Gerard Swope and Owen D. Young, who will become honorary president and honorary chairman of the board, respectively.

CHAIN STORES MODERNIZE

Chain store companies spent a total of $126,159,914 for remodeling old stores and constructing new ones this year, according to the annual modernization study made by *Chain Store Age*. This total is 12.2 per cent higher than the amount spent by the chains for store modernization in 1938 and is the highest recorded since the first study of the kind made in 1933, running 1.3 per cent above the previous high figure of 1937. This expenditure indicates progress in modernizing stores rather than expansion in number of stores operated by the chains, the study shows. The number of new stores opened equals 4.5 per cent of the total number in operation but this includes relocations and replacements, making no allowance for the number of stores closed this year. The total number of chain stores now in operation is somewhat smaller than the number in operation a year ago. The number of old stores remodeled in the year is equal to 10.7 per cent of all chain stores in operation.

Expenditure by all chains for air conditioning was $7,578,357 this year, according to the survey. This compares with $8,254,727 in 1938 and $10,902,950 in 1937.

WARTIME TRADE DISRUPTIONS DEMONSTRATE INDUSTRIAL MATURITY OF UNITED STATES

The shift in impact of wartime trade disruptions during the past 25 years demonstrates well the maturity of the United States as an industrial nation, says the *Industrial Bulletin* of Arthur D. Little, Inc. In 1914 the abrupt and complete cessation of trade with Central European countries in finished and semi-finished producers' goods gravely dislocated numerous industries. Today we are virtually independent of industrial Europe, but the growth of our manufacturing has swelled our needs for imported raw materials, despite our growing self-sufficiency in some materials, to a volume much above that of 1914. Since these materials are obtained largely from countries with which war has not, and most likely will not, break off communications, the predominant effect on our industries after the first speculative flurry will probably be, not actual shortages, but higher prices as high-cost producers, domestic and foreign, go into operation to supply wartime demand.

New needs, expanded needs, and depleted domestic resources have increased our dependence on imports for many raw materials. The burgeoning aluminum industry has outstripped domestic supplies of its raw material, bauxite, and now imports over half of its requirements, largely from South America. American peacetime production of chromium, used in stainless steel and refractory manufacture, is almost nil, and our consumption in 1937 was three times the 1918 wartime consumption. The low grade, scattered deposits in the United States probably cannot again supply the 45 per cent of our consumption that they contributed in 1918, even at much higher prices.

Industrialists may be encouraged, however, by the fact that nearly all of these materials are obtained, in substantial part at least, from countries from which there is now little prospect of our separation by blockade. In general, rather than scarcity, the penalty will be higher prices to cover increased production costs and shipping risks.

MEETING REPORTS, INDEX FEATURE THIS ISSUE

A feature of this month's issue of HPAC is the volume index, which appears each December. The index—pp. 789-800—lists all of the articles published during 1939 and follows the same form as in previous years.

November was a "month of meetings" with the eastern air conditioning conference at Lehigh University and the production conference of the American Management Association at Chicago. The first included discussions on many uses of air conditioning—such as hotels, hospitals, educational buildings, blast furnaces—and the second featured applications of air conditioning as a production tool and as a factor in industrial preparedness. Reports on both of these "get-togethers" appear this month, as well as one on the annual convention of the American Welding Society which was held during the latter part of October and therefore could not be covered in our November number. The Atlanta meeting of the American Society of Heating and Ventilating Engineers is reported in the ASHVE *Journal Section*.

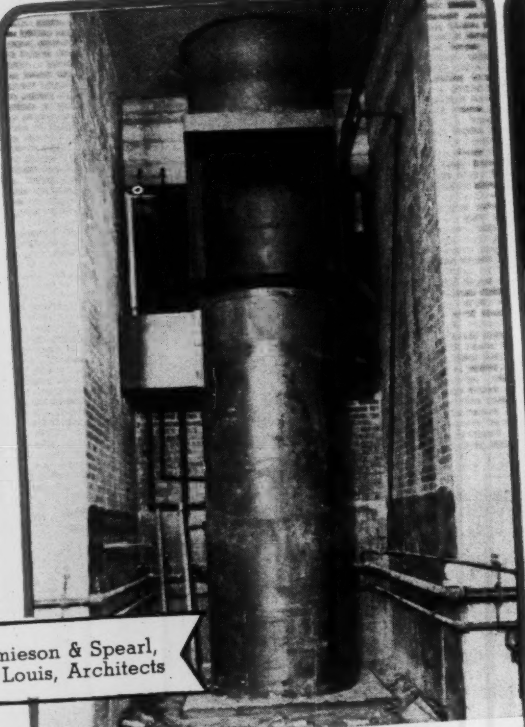
NEW CONSULTANTS ON AIR CONDITIONING

E. P. Heckel, who has been identified for many years with general air conditioning and industrial process engineering work, has announced that he will have offices and an engineering staff in association with Samuel R. Lewis of Chicago, at 407 S. Dearborn St. Mr. Heckel's New York City associate is H. B. Matzen. The business will be conducted in the name of E. P. Heckel and Associates, and will be devoted primarily to air conditioning in all its phases, industrial as well as comfort. Mr. Lewis will continue his consulting business as heretofore in his own name. Both Mr. Heckel and Mr. Lewis are members of HPAC's board of consulting and contributing editors.

CORROSION COSTS YOU MORE THAN WROUGHT IRO

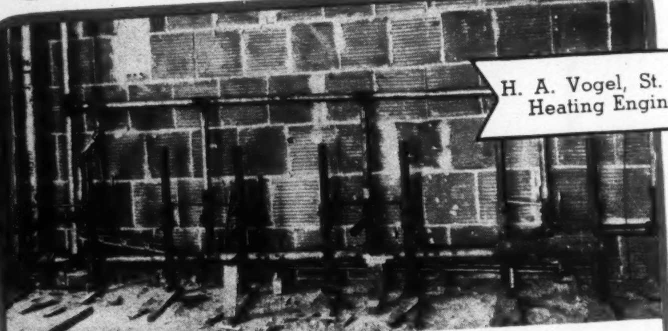
Missouri State Cancer Hospital Prevents Pipe Ills in 7 Corrosive Services with

BYERS WROUGHT IRON



Jamieson & Spearl,
St. Louis, Architects

Smokestacks and Boiler Breeching



H. A. Vogel, St. Louis
Heating Engineer

Waste Lines; Soil Vents above Ground Floor

Heating Lines: Water Softening Piping; Fire Hose Piping; Gas Piping

The importance of careful selection of materials for hospital service lines is magnified because human welfare, as well as maintenance costs, are directly involved. In the Missouri State Cancer Hospital, careful preliminary studies indicated that waste lines, soil vents above the ground floor, fire hose piping, water softening piping, gas piping, smokestack and breeching, and heating lines were corrosive services. Byers Wrought Iron was used in all seven.

The widespread use of Byers Wrought Iron for corrosive services is suggested by a glance at the record. The Charity Hospital, New Orleans, La.; Lourdes Hospital, Binghamton, N.Y.; United States Naval Hospital, Philadelphia, Pa.; Malcolm A. Bliss Psychopathic Institute, St. Louis, Mo.—are a few of the many that use Byers Wrought Iron.

A glance "at the record" can also simplify the predetermination of corrosion danger points, and the proper selection of material for you.

If you will write, outlining your particular problem, our Engineering Service Department will (1) Determine the probable types of corrosion involved; (2) Relate these to similar conditions encountered elsewhere; (3) Interpret the results in the light of 75 years' experience with corrosion problems; and (4) Make recommendations . . . supported by service records. For a graphic picture of the many places where wrought iron is solving corrosion problems today, ask for a complimentary copy of our bulletin, "101 Uses for Wrought Iron."

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

Specify Byers Genuine Wrought Iron Pipe for corrosive services and Byers Steel Pipe for your other requirements.

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Design, Installation
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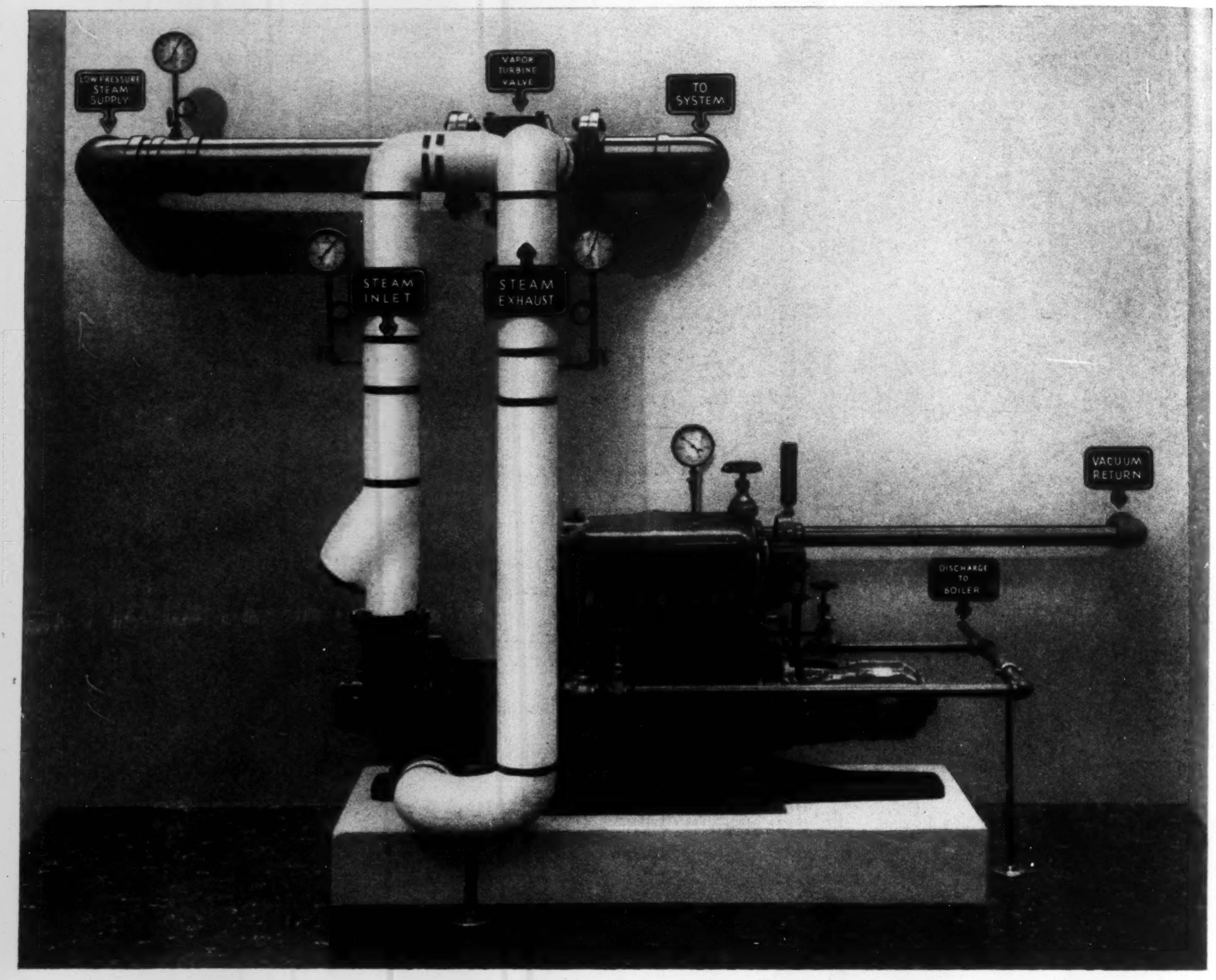
Where Heat Must Not Fail—
Install this SAFE Heating Pump!



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is independent of electric current failure, and continues to operate as long as there is steam in the system.

This is because the prime motive power of this economical pump is a special steam turbine, controlled by a unique "Vapor Turbine Valve", which automatically bypasses from the heating main a small portion of steam, the exact amount necessary to develop the power needed to remove the condensate and maintain the required vacuum on the system. Even this small amount is passed immediately back to the mains, and goes on to the system with little heat loss. This pump operates on any system, high or low pressure.

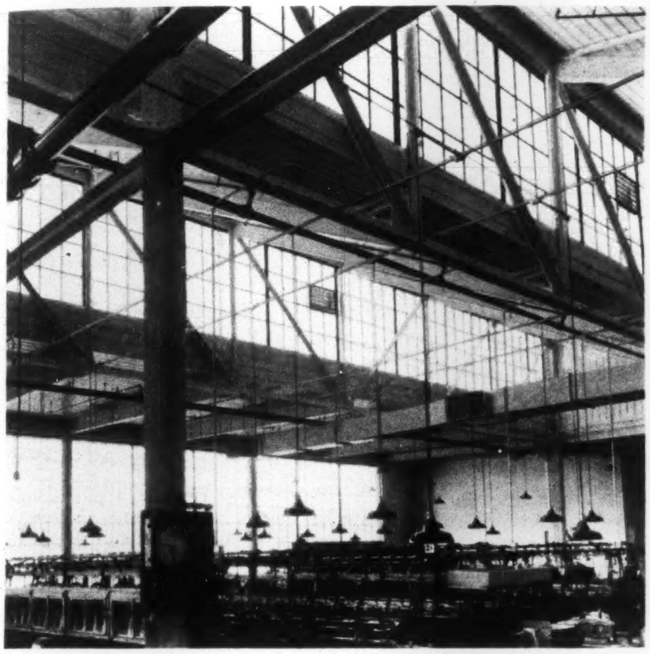
The Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump. Bulletin on request.

THE NASH ENGINEERING COMPANY
205-A WILSON ROAD, SOUTH NORWALK, CONNECTICUT, U. S. A.

Heating·Piping and Air Conditioning

Vol. 11, No. 12 • *December, 1939*

Air Conditioning as Production Tool a Factor in Industrial Preparedness



Air is distributed through diffusing type outlets in this knitting mill. The air relief dampers in the skylight make it unnecessary to have ventilators through the roof. The automatic control may be seen on the post in the foreground

THE 1939 production conference of the American Management Association held at the Palmer House, Chicago, last month represented in some respects a departure from conferences of previous years in that plant facilities and equipment were emphasized rather than techniques of production control. The theme of the meeting was "industrial preparedness," and special attention was given to the effect of war conditions on production management, for—as pointed out by Harold Vinton Coes[1]—the continuation of the European war will mean a continually increasing volume of production in American factories which will in turn build up payrolls and thereby increase domestic consumption. Our own rearmament requirements, athough spread over a period of several years, will also affect this upturn, as will shifts in international markets.

Air conditioning, heating and ventilating as production tools were given attention at the conference. A. E. Stacey, Jr.,[2] lead off the air conditioning sessions with a discussion of the development of equipment.

Development of Air Conditioning

Within the last 40 years (said Mr. Stacey) the heating, ventilating and air conditioning industry has grown from less than five million dollars to one of over 100 million dollars. During this period of expansion, much new equipment has been developed and marketed.

Before 1900, large plants were heated either by steam pipe coils along the walls or by a fan system with all of the heating surface in one location. Many smaller plants were heated by stoves (with attendant fire hazard) sparsely distributed through working areas. The need of humidifying, as well as heating, was recognized in the textile industries. Open steam pots for humidifying were responsible for the earliest laws limiting the temperature and relative humidity in places where people work.

Ventilation during this period was limited, largely through ignorance, to alleviating conditions of annoyance such as the removal of large volumes of steam or fumes, which were irritating to the mucous membrane. Little was known of the seriousness of industrial poisons.

Early Developments—About 1904, a spray type humidifier of the type used today was installed as an addition to a central fan heating system in a cotton mill and successfully humidified the mill during the heating season. The air capacity of this system was not sufficient to absorb the heat of summer and machinery to main-

The theme of the American Management Association's production conference last month was "industrial preparedness", with special attention being given to the effect of European war conditions on production management. The discussions represented a departure from previous years in that plant facilities and equipment rather than techniques of production control were emphasized. . . . Air conditioning, heating and ventilating as production tools were given attention by the conference, and examples of air conditioning's uses were presented

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[1] Manager, Industrial Dept., Ford, Bacon & Davis, Inc.

[2] Buensod-Stacey Air Conditioning, Inc.

tain the humidity, although conditions were greatly improved. In 1904, Colonel Steward W. Cramer coined the term "air conditioning." He was a mill owner and operator and so was accustomed to designate as "conditioning" the addition of moisture to yarns. In a talk before the American Cotton Manufacturers Association on mill humidifying, he spoke of "air conditioning."

Dr. Willis H. Carrier, after developing the spray type humidifier, patented many systems of automatic control. The well known dew point control was conceived and used at this time. Other humidity controls were based upon the differential temperature between the dry bulb and the wet bulb, and were located in the rooms controlled. Colonel Cramer was also active in the development of control systems at this time and patented a relative humidity controller, which is still being used. Multivane fans were introduced into this country from England. Their efficiency was 60 per cent, which was much higher than the paddle wheel type then in use, which had an efficiency of only 45 per cent. This development has continued over the years so that today there are fans having an efficiency of over 70 per cent. A new type of blast heater made its appearance at this same time, and the spray type dehumidifier was developed. The six years from 1904 to 1910 might be designated as the "golden era" of air conditioning, as there was developed a great proportion of the equipment used today.

Between 1911 and 1915, air conditioning was applied to many industries. The Warner Brothers Instrument Co., makers of precision instruments at Beloit, Wis., made an installation to protect the fine parts from dust and assist in the assembly. The Woodward Ave. plant of the Ford Motor Co. was air conditioned to make the plant cleaner, but also to keep it cooler in summer for the comfort of the workmen. Installations were made in pharmaceutical plants to reduce the humidity in those departments handling deliquescent salts. The moving picture industry was starting and air conditioning was needed to control the temperature in the studios and for drying the developed films.

Duct Design—During this period, the design of duct work was entirely changed. Circular ducts were customary practice, being simple to fabricate and having a cross section of highest efficiency for the carrying of air. Larger installations caused a problem to find space for the round ducts and it became necessary to use other forms, usually rectangular. Some owners objected to the rectangular shape as the top of the duct would form a dust pocket, while the dust would vibrate off from a round duct. Today, the only circular duct used is in exhaust systems, where there must be no corners with low air velocity.

Effect of World War—By 1915, the world war was on in earnest and the U. S. was busy manufacturing ammunition for the allies. The fires and explosion hazards in the loading plants were great and special developments were necessary to protect the spread of fire from one department to an adjoining one. Water traps and screens were devised which proved thoroughly effective.

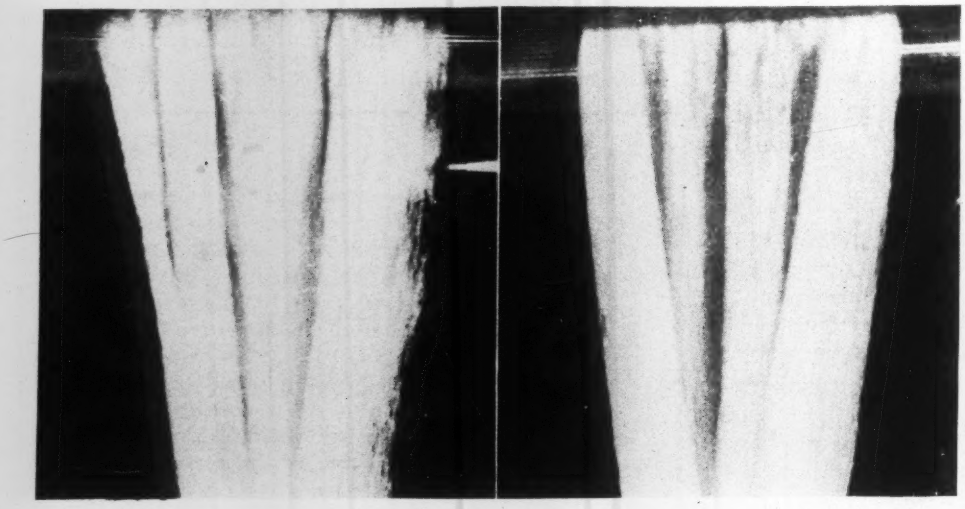
Another problem developed in the heating of the shells before being loaded with TNT. This same problem exists in machine shops doing precision work. The material must be brought to a predetermined temperature and maintained at that temperature during processing.

Units Developed—Probably the majority of the new plants built during the war were heated with direct radiation and the remainder by hot blast. About 1922, a new development in industrial heating appeared—the unit heater. Development of light weight extended fin blast radiation assisted in the rapid evolution of the unit heater. A parallel development was the design of unit air conditioners.

With the development of units, a less expensive method of temperature and humidity control was needed. The pneumatic controls are expensive for small installations since, no matter what the number of control instruments, there is still the necessity of an air compressor, motor and tank with reducing valve, etc. This expense is not great when spread over a number of instruments but where one or two thermostats or hygrostats are involved, the cost of this part of the equipment is excessive. There are now available electric controls of dependability and desirable sensitivity.

Tremendous Possibilities—There is no doubt that, as mechanical difficulties are overcome, there will be an increase of speed, whether in air velocities through ducts or in the revolutions of moving parts of equipment. This will fulfill the need for smaller space requirements, less weight and no doubt eventually result in lower first cost.

There may also be expected laws and codes governing permissible temperatures and relative humidities for different industries. Codes will be written on the allowable concentrations of toxic fumes, vapors and dust particles. In some states today, there are existing codes



Importance of humidity control in the cotton textile industry. *Left*—When dry atmospheric conditions prevail. sliver from the drawing frames is ragged and irregular. *Right*—When the humidity is adequate, the product of the drawing frame is smooth and even (from paper by W. B. Henderson; courtesy of Parks-Cramer Co.)

covering these points. A great amount of research is being carried on at the present time to determine the physiological reactions of persons at different rates of activity when subjected to various temperatures and humidities.

Forty years of development of air conditioning has opened up tremendous possibilities in every phase of life. The same research and application which has resulted in lower unit power consumption, smaller space requirement, and better installations at lower cost will continue to solve industrial problems to the benefit of management, worker and consumer in the years to come.

Boost Output by Air Conditioning

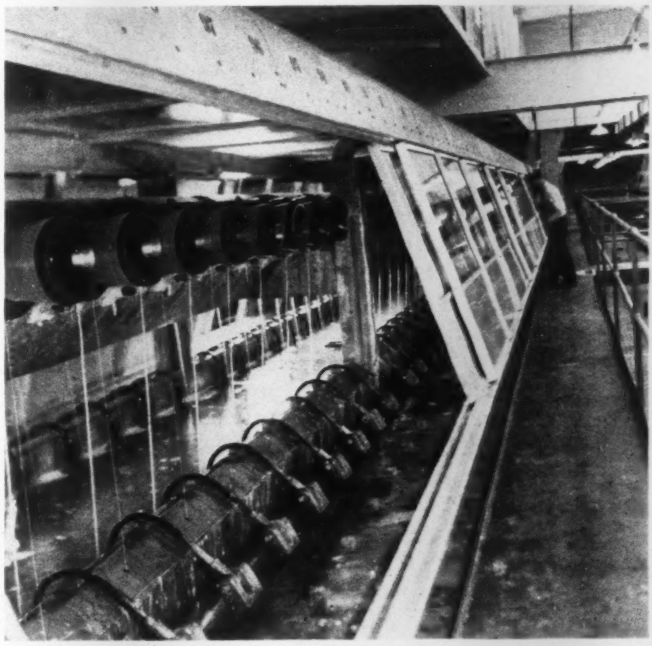
The rôle of air conditioning in stepping up production rates in industry, and leveling out the weather variations which plague manufacturers of materials sensitive to temperature and humidity, was described by W. B. Henderson.[3] There are today over 2000 industrial air conditioning installations in manufacturing plants throughout the country, he said, resulting in improved quality of product, lower manufacturing cost, protection of inventories, and improved health and efficiency of employees.

As a prime example, he cited the textile industry which, before the age of air conditioning, sprung up in New England because the natural climate there was the best in the country for spinning and weaving operations. Now rendered almost completely independent of the weather through the development of air conditioning, most of the textile plants have moved southward, where they are close to sources of raw materials. Another large user of air conditioning is the food industry, whose varied processes require temperatures ranging from 0 to 80 F and relative humidities from 35 to 85 per cent. In these applications, air conditioning has raised the quality of such foods as bakery goods, fruits, meat, milk, candy, flour, and vegetables.

Mr. Henderson mentioned how air conditioning is used by machinery manufacturers to reduce loss by rejections of accurately fitting steel parts whose size (and the size of the production and inspection gages for the manufacturing process) varies with the temperature. In these cases, the elimination of dirt from precision manufacturing processes has been an important factor, in some cases resulting in direct savings which paid for the air conditioning in less than a month.

When a plant is air conditioned in order to make the manufactured materials behave better during the production process, almost invariably the health and efficiency of employees are also improved, he declared. Thus illness of workers is reduced, and their efficiency is substantially increased because they are more comfortable at their tasks.

Mr. Henderson remarked that air conditioning—particularly for industrial use—is a specialist's job. Each installation must be engineered, and must stand on its own merits as far as the savings it will bring are concerned. Cheapness is not synonymous with economy, he warned. He concluded by stressing the point that air conditioning is a profitable production tool, and the question is not so much whether or not a plant can afford it, but is rather one of whether the plant can afford to be without it.



On the upper level of each machine at the Industrial Rayon plant are 100 gear pumps through which the measured flow of viscose is carried to the dilute sulphuric acid in lead lined spin tanks where coagulation of the yarn takes place. One hundred spinning reels of a chemically resistant plastic draw the newly formed yarn filaments up from the bath inside a hood of aluminum and glass at this level. Vapors inside hoods are carried off by an exhaust system drawing 10 cfm for each spinning position

Electrostatic Air Cleaning Demonstrated

Electrostatic precipitation was demonstrated by George F. Begoon.[4] He discussed its principles of operation and constructed a typical small air cleaning installation from full-sized precipitating apparatus and ducts. He gave case examples of how electrostatic precipitation has been applied in many industries—textile, steel, cement, glass, communication, ceramics, and others—not only for air cleaning, but also for the recovery of valuable byproducts which in many instances have paid for the cost of apparatus within a relatively short time. Product improvement, reduction of maintenance costs through dust control, and improvement of employee health are other benefits derived from clean industrial air, he said.

Rates of dust fall in various cities were mentioned. Pittsburgh has a rate of 1900 tons per sq mi per mo, he said, while the figure for Chicago is 1530.

In concluding his discussion, Mr. Begoon mentioned representative installations of electrostatic cleaning equipment, particularly a steel mill where it is to be used for cleaning the air for cooling the electrical motors. Instead of recirculating the cooling air over surface coolers through which water is circulated, 100 per cent outside air is to be used; in summer the heated air will be exhausted outdoors but in winter it will be used to meet a part of the plant's space heating requirements.

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[3] Executive vice-president, Air Conditioning Manufacturers' Association.

[4] Manager of Precipitron Sales, Westinghouse Electric & Mfg. Co.

Comfort and Efficiency

In the session devoted to how atmospheric conditions affect employee efficiency, F. C. Houghten[5] described in detail the great amount of work that has been done at the research laboratory of the American Society of Heating and Ventilating Engineers, and in coöperative research at Minneapolis, Washington, and San Antonio. He also explained the ASHVE comfort chart. While there is much information on the proper air conditions for comfort, he said that there is as yet little or no data based on specific, measurable tests on how efficiency is affected.

Dr. S. N. Stevens[6] asserted, in a luncheon address at the conference, that the American worker is better protected today against occupational diseases, accidents resulting in bodily harm, and excessive fatigue than at any time in the history of man's work; the problem of creating a healthy psychological and social environment for the worker is the major one facing management today. He mentioned in his talk the experiences of a number of firms having air conditioning and its effects in reducing absenteeism due to colds and minor illnesses, elimination of afternoon fatigue, etc.

Air Conditioned Plants of Tomorrow

A session on "plants of tomorrow in operation today" was a feature of the conference, and experiences with several air conditioned industrial buildings were reported.

L. J. Jordan[7] discussed the design and construction of the Industrial Rayon Corp.'s new plant at Painesville, Ohio, for the continuous production of viscose rayon yarn. In 1932, Industrial Rayon's general management reached the conclusion that manufacturing methods which required repeated handling of yarn and its treatment in package form were unsound, and reasoned that it must be possible to run yarn through the entire processing sequence in continuous lengths without repeated winding and all the handling this entailed. It was indicated that the problem could be solved by arranging all the processing steps in a vertical sequence on a single machine, which would spin yarn at the top and process it as the yarn worked its way down over a series of thread-advancing reels. Since atmospheric conditions have a marked influence on the raw materials and the materials in process—as well as on the finished yarn, which must be shipped on a 10 per cent moisture basis—air conditioning of all manufacturing departments and the warehouse was required. The management went all the way, and also provided air conditioning for all offices, the dispensary, locker rooms, kitchen, and cafeteria, he said.

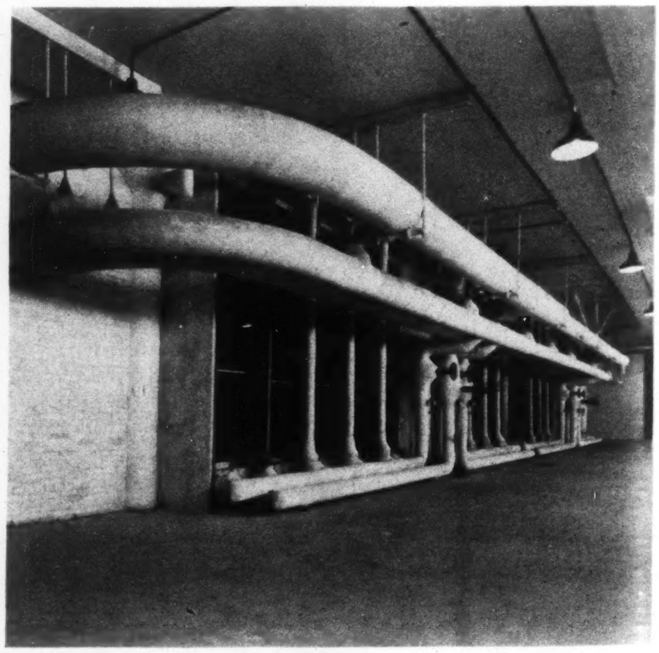
Fifteen hundred tons of refrigeration is required for the various air conditioning systems in the plant. None of the air in the spinning room is recirculated, so that more than 400,000 cfm of air must be delivered through the ducts in this room alone. Water requirements for the power plant, condensers, processing, sanitation and air conditioning aggregate 15 million gallons per day, which is provided by a 48 in. main reaching nearly a mile into Lake Erie.

Piping for carrying the various liquids, steam and air is concentrated in a 450 ft basement corridor. Special catwalks in this corridor and under the spinning room provide direct access to 50 miles of pipe lines, 12 miles of which is hard rubber in diameters up to 8 in.

W. J. Austin[8] described the engineering of the Simonds Saw & Steel air conditioned, windowless plant at Fitchburg, Mass. [Articles about this plant appeared in Heating, Piping and Air Conditioning, September, 1939, p. 35, front section, and November, 1938, p. 711.] Ten years ago, when the idea of the plant was first conceived, air conditioning had begun to make its appearance in some industries but always because the process required it. There was no such thing then, according to Mr. Austin, as atmospheric control for comfort throughout an entire factory. The Simonds management reasoned that "if production equipment needed ball bearings and specially refined oils for the smooth operation necessary to attain its budgeted output, the people in a plant might also require some real control over the conditions under which they worked."

In the old Simonds plant, as in many other industries, furnaces and other heat producing equipment have always presented serious problems. The only way to meet them was to isolate furnaces, ovens and heat producing equipment in separate buildings. Because there was no back-tracking this was called "straight-line production." In the new Simonds plant 70 heat treating furnaces have been placed at the exact points where they are needed in production lines. That of course makes a lot of heat to remove, but with roof ventilators strategically placed above the furnaces and curtained ceiling areas to trap the heat, the problem is greatly simplified. Air is cir-

A view of the cooling chamber serving the Industrial Rayon Corp.'s air conditioned, windowless plant. Each department in the 14 acre plant receives air at the proper temperature and relative humidity to meet its particular need. Close atmospheric control makes possible production of yarns adhering closely to exacting specifications of fineness and physical characteristics



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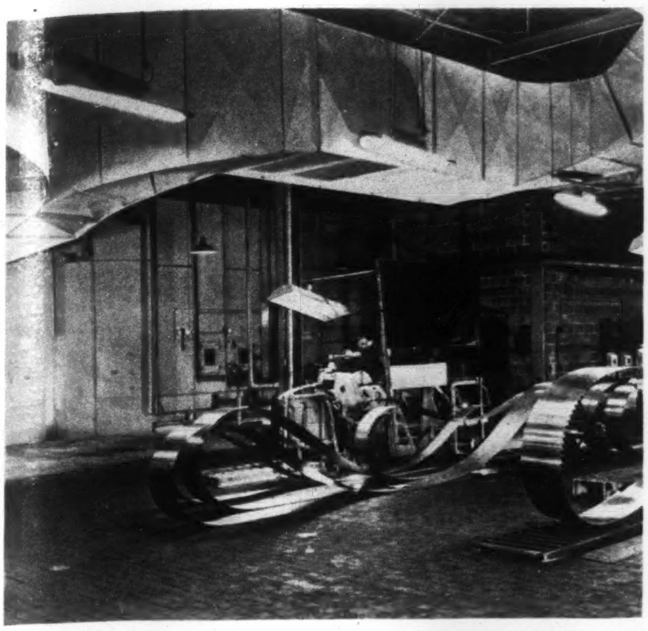
[5] Director, ASHVE Research Laboratory.

[6] Northwestern University.

[7] Chief Engineer, Industrial Rayon Corp.

[8] President, Austin Co., Engineers and Builders.



One of the four large air conditioning units at the Simonds plant, which use 1100 gpm of 52 F water from four wells. There is a complete air change in this windowless plant each 12 minutes

culated through the plant at a rate of 400,000 cfm by four large air conditioning units. With a complete air change every 12 min, process heat never becomes a problem.

Furnace heat was not the only complication. With hundreds of grinding wheels in operation it was necessary to keep dust particles under control, so 30 dust removal units, with many times that number of connections, were installed to catch dust particles at the sources. The air which carries them is filtered and recirculated through units, from which underfloor ducts lead to machine locations within a radius of 30 ft. Three asbestos lined underground flue gas exhaust systems dispose of the furnace gases, which are kept under close control. Ventilation and dust removal problems are thus mastered by these systems—the 30 dust removal units, the 42 roof ventilators and the air conditioning system.

The air conditioning units use water at 52 deg from four wells providing a flow of 1100 gpm to wash and cool the air before it is circulated in the plant. Altogether these facilities keep the air clean and the plant comfortable. Temperature and relative humidity are maintained at ideal levels throughout the year, with only nominal fluctuations. The temperature is held at 70 and the relative humidity between 47 and 48 per cent.

Unique Piping System at Campana Plant

Plant Manager R. D. Frick reported the benefits the Campana Corp. has derived from its new air conditioned plant near Batavia, Ill. [The heating and air conditioning of this plant was described by Samuel R. Lewis in the August, 1938, Heating, Piping and Air Conditioning.] The design of the plant was unusual in that the industrial layout was made first, following which the structural engineer and the architect designed a building to house it. The relative status was decided upon as first industrial engineering, then mechanical and structural, and then architectural, "with an honest effort to correlate the three into a satisfactory, composite result."

Mr. Frick said that the outstanding thing about the production and processing operations carried on in the plant is the automatic control, which is controlled throughout by photo-electric "eyes." The heart of the production line is the automatic control of the weighing, proportioning, batching and measuring of the various ingredients, specifications for which are very exact.

The first operation consists of blending high-priced essential oils, which is performed on a scale sensitive to 1/100 of an ounce. The exact amount of material is weighed out within a tolerance of 1/50 of 1 per cent. After they are blended these essential oils are automatically proportioned and mixed with alcohol to make a concentrate of specified quality. The proportioning of this alcohol is performed by a scale with photo-electric cut-offs. The concentrate is then pumped to storage above another scale where it is further batched with several other ingredients. All of this processing is automatically controlled by the scale and all electrically interlocked so that diverting valves are opened, agitators are started at the proper time and each individual ingredient weighed out with very close tolerance and in proper sequence.

The remote control panel board is of particular interest; it has two panels, one for each of two formulas. A production order being issued for a certain number of thousands of gross is routed through the chemical control laboratory. The chief chemist provides the processing department foreman with a key to open one or the other of the doors on this control panel board. The board is so designed that even though the operator could have two keys (which he does not have) only one door could be opened at a time unless a third key is obtained from the plant manager. This third key is used only when it is necessary to have both panels open at the same time for periodic checking of controls inside the board.

The board is equipped with pushbutton control, automatic interlocking in sequence, time delay switches and indicator lights. For instance, the first button pushed, energizes electrically operated solenoid and motor operated valves on pipe lines. As these valves receive energy, a red pilot light opposite the button comes on and after the valves have opened or closed to their predetermined position the red light goes out and a green light opposite it comes on. Then the operator can proceed with the next step, pushing the second button, which turns out the green light of the preceding step and starts an agitator in a concentrate tank, lighting the red pilot light opposite the second step, and so on down the various steps of the panel board. Each button must be pushed in its proper sequence and even though it is pushed by the operator before the preceding step is completed nothing will happen.

The batching equipment thus is so designed that once the operator starts on a certain batch of material each ingredient is automatically introduced in sequence, agitation takes place at the proper time interval and the batch is completed before the operator can start another batch of the same or different material.

[*Concluded on p. 738*]

Pipe Welding Problems Get Attention at Welding Society Annual Convention

Among the papers presented at the annual meeting of the American Welding Society of particular interest to piping engineers were discussions on welded nozzles and their reinforcement, the extension of fusion welding in special pipe and pipe fitting applications, oxy-acetylene welding of red brass pipe, and the use of welding in the manufacture of valves for high pressures and temperatures. Brief descriptions or abstracts of these papers are given here; the complete papers—with the others presented at the meeting—are available in various issues of the *Journal* of the AWS. The meeting was held at the Stevens Hotel, Chicago, the latter part of October.

Reinforcement of Welded Nozzles

F. C. Fantz[1] and W. G. Hooper[2] presented a method for determining whether or not reinforcement of welded nozzles is necessary, and in case reinforcement is necessary, how much additional metal must be added and by what method. According to the authors, various ASA codes have established definite rules governing the design of piping systems with formulas developed for ascertaining the wall thickness of pipe and welding fittings and the strength of butt and fillet welds. However, there is nothing in these codes that can be applied to the design of nozzles attached to headers or piping that would determine when reinforcement might be necessary to compensate for the weakening of the header due to the removal of metal for the nozzle opening. The ASME code for unfired pressure vessels applies primarily to the materials, design and manufacture of vessels such as tanks, separators, receivers, etc., and its rules are not intended to apply 100 per cent to the fabrication of piping materials. However, this code does cover the design of welded nozzles attached to unfired pressure vessels, and as it is the recognized code with formulas covering the attachment of nozzles and their reinforcement when necessary, it is logical that the piping designer accept these rules and be governed in his design by section U-59 of the code for unfired pressure vessels as revised August 15, 1938. While this section is clear and simple to the boiler designer, who is using it constantly, it may seem complex and the rules governing design appear cumbersome to the piping designer. Thus the object of the paper was to clarify these rules and set them up in the form of simple algebraic equations, with graphs for the calculation of the several constants used.

The authors then gave a step-by-step analysis and example of the use of the method and presented the necessary tabular data. If it is determined that reinforcement is necessary, this can be accomplished by three different methods: (1) by adding additional metal, (2) by welding a ring or collar to the header and to the nozzle, and (3) by the use of a reinforcing saddle welded to the header and to the nozzle.

In concluding the discussion, the authors stated that the design of welded piping presents a problem which (no doubt) was not specifically considered by the ASME boiler construction code. Nozzle intersections on piping are generally constructed of tubing material of the wall thickness demanded in the line by the temperature and pressure conditions, which makes it necessary to reinforce that point where an abnormal strain is set up due to the design of the intersection. Tests conducted by engineering offices and manufacturers in connection with ASME committee work have demonstrated that the flat portion of a branch intersection weld reinforced with a welding saddle has deformation to a point where additional reinforcement is necessary. This can be accomplished by having a sleeve or collar encircling the nozzle intersection and made a part of or attached to the ring section on the header. (This sleeve or collar may not be necessary where the nozzle diameter is below 75 per cent of the header diameter.) When a pipe line is in use, stresses are concentrated at the point of intersection, caused by expansion and contraction of the various parts of the piping assembly. It is thought that the saddle type of reinforcement with the collar encircling the nozzle will minimize and better distribute these stresses. There is available on the market nozzle reinforcing saddles consisting of a collar integral with the ring or saddle—thereby combining the nozzle reinforcing collar and the reinforcing ring. As the collar of the saddle is fillet welded to the nozzle and the ring is welded to the header, the authors believe this type of reinforcement should be given equal value as the ring type when applied to the header, plus additional reinforcement to compensate for the flat section on the nozzle and localized stresses set up due to expansion and contraction.

A written discussion prepared by Arthur McCutchan[3] was read by D. H. Corey. Mr. McCutchan pointed out

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[1] Vice-president, Midwest Piping & Supply Co., Inc.
[2] Vice-president, Midwest Piping & Supply Co., Inc.

[3] Engineer, The Detroit Edison Co.

..... Speakers at American Welding Society Annual Meeting Present Papers on Reinforcement of Welded Nozzles, Welding Red Brass Pipe, Special Uses of Welding Fittings, and Welding in Valve Manufacture

that, as is natural when definite design rules are not provided by some code body, differences in interpretations of design principles result. While the practice followed by Detroit Edison engineers is based on the same boiler code rules, it might be said to follow the spirit rather than the letter of the law and in general the result is to provide somewhat greater reinforcement than would be found necessary by the formulas proposed in the Fantz-Hooper paper. By spirit of the law is meant adherence to the principle of replacing metal removed from the header by an equivalent cross section of metal in the nozzle, weld, and supplementary reinforcement.

In computing the necessary thickness of header and nozzle for a given pressure and temperature condition, it seemed to Mr. McCutchan that the code for pressure piping formula should be used rather than the formula given in the unfired pressure vessel code, as the latter employs an efficiency factor which is meaningless for seamless pipe but does not include an allowance for corrosion. Although these factors more or less compensate for each other, the code for pressure piping formula appears to be more logical for piping work, he said. Mr. McCutchan also felt that as the need for reinforcement must in general be determined in advance of assembling the actual pipe, that the minimum thickness permissible on inspection, rather than the nominal thickness, should be used in the proposed formulas.

Tests have, indeed, demonstrated, said Mr. McCutchan, the need for additional reinforcement of the sides of full size branch connections. He showed the heart-shaped contour lines of stress in the outer surface of an 8x8 in., Schedule 80 welded branch connection [this figure was published as Fig. 9 on p. 218 of the April, 1939, HPAC] which indicate that the sides of a manifold have a definite tendency to assume a spherical shape. As a result of tests, a new style of reinforcement was developed by The Detroit Edison Co. which is intended to prevent failure in or adjacent to the welded branch connection and to limit side distortion within acceptable limits. The reinforcement consists of a ring and side plates [this method of reinforcement was illustrated as Fig. 11 on p. 218 of the April, 1939, HPAC]. While the saddle type of reinforcement will cover much the same area as this reinforcement with side plates, Mr. McCutchan questioned whether a saddle really provides the necessary support at the flat sides of a branch connection.

The discussion commended the authors for the simplicity of the formulas and charts they prepared and concluded by saying that the question of the adequacy of reinforcing saddles—or for that matter, the ring and side plate design—will have to remain a matter of opinion until actual test data are presented.

Welding Red Brass Pipe

Arthur N. Kugler[4] presented a paper on the oxy-acetylene welding of red brass pipe, consisting of 80 to 85 per cent copper and 20 to 15 per cent zinc, which he said is used extensively where corrosion conditions are particularly bad. Among the service conditions under which red brass is successfully operating are boiler feed lines and steam return lines in which high concentrations of boiler compounds exist, and domestic hot water systems operating at temperatures of 120 to 150 F. The severe service conditions to which such pipe is subjected indicate the necessity of joints capable of rendering equally satisfactory performance; thus, the welding process is looked upon with favor and is specified.

Investigation and research directed toward improvement of the braze welding processes disclosed that difficulties lay not with the various rods, but with the fluxes, according to the speaker. Efforts were therefore directed to improvement of fluxes, with the result that a liquid or semi-paste formula was developed which yields welds of high physical properties equal and in most instances exceeding those of the base metal. Another important property of such a flux is virtual elimination of fumes.

Mr. Kugler then described the welding of brass pipe in detail, illustrating his discussion with colored slides and movies, showing how the flux is applied to the pipe ends and the rods, the proper flame adjustment, tack welding pipe, and making welds in various positions. Fluxing of the rods is best accomplished by dipping them in a copper or brass container 18 to 20 in. long into which the flux has been poured. These flux containers for the job may be readily fabricated of odd lengths of 1½ in. copper or brass tubing by closing one end with welding and welding on either tripod legs or a flat plate base. The container should be provided with a stirring

CARBID
QUARTER

Vertical pipe position weld on red brass pipe—the stand for flux coating rods may be seen in lower lefthand corner of photo

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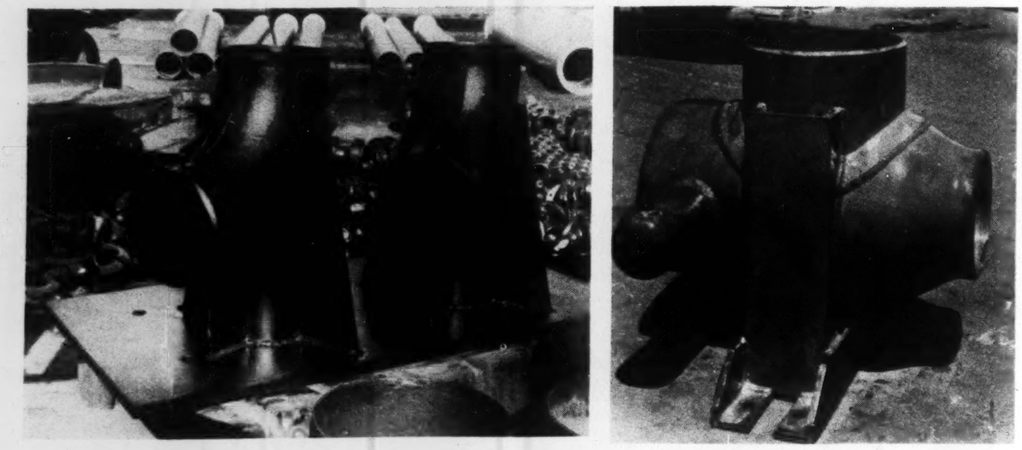
[4] Mechanical Engineer, Applied Engrg. Dept., Air Reduction Sales Co.



Left—Base fitting made from two standard ells joined to a fabricated base. *Right*—Rigid base fitting made by combining a channel and angles to a reducer

rod for mixing the flux after it has been standing; this is made of a welding rod to which has been welded a disc of copper or brass of a size that will readily pass up and down the tube. In operation, six or eight rods are placed in the container by the helper who raises them up and down in the flux several times to coat them evenly. One or two rods are withdrawn from the flux and allowed to air dry for a few moments before being used in welding. The operator uses only the flux coated lengths of the rods and temporarily discards the uncoated ends. At a convenient time later, the helper or the welder tacks these discarded uncoated ends together to form lengths suitable for coating.

In conclusion, the speaker remarked that of special interest was the welding of galvanized pipe by the procedure he described. By coating galvanized surfaces for 3 to 4 in. on each side of the weld, the galvanized surface is preserved intact during the braze welding, and the deposited bronze flows up to and overlaps the zinc to produce an assembly that is corrosion resistant.

Special Pipe and Pipe Fitting Applications

E. Hall Taylor[5] gave a discussion of the extension of fusion welding in special pipe and pipe fitting applications. He described novel advances which have been successfully carried on recently in the fabrication of a high pressure fusion welded penstock for a Pike's Peak installation. The maximum static head on this line is 2160 ft, which under surge conditions is equivalent to 1315 lb per sq in. Because of the special nature of the joints for this line, it was necessary to forge upset the ends of each pipe section, thus subjecting the electric fusion welded seam to extremely severe deformation.

So far as it is known, this was the first time such drastic forging procedure was successfully attempted on fusion welded pipe, particularly for critical services under impact stress conditions. The forging operation consisted of heating the pipe end to about 2200 F and then clamping a section at a time between dies. One of the dies was advanced, pushing the metal back upon itself to fill the die cavity. This operation was repeated, using a second set of dies, to form the completed end.

The visual impression of the forging operation was a favorable one and the weld metal forged as easily as the parent metal, being indistinguishable from the parent metal after the completed operation, the author said. There was no external sign of any irregularities due to lack of proper forging characteristics, and to further check this, x-rays were taken through the forged weld metal which showed weld and parent metal of identical density in the upset portion as well as the adjacent pipe. Macro, micro, tension and izod impact tests at room and subnormal temperatures also showed the weld metal equal to or better than the parent metal when both were subjected to identical forging operations.

Mr. Taylor devoted the second part of his paper to the extension of fusion welding in the field of special pipe fitting applications. Combining several standard fittings by welding to form a special pipe fitting is a growing practice, he said. For example, special high pressure steam headers can be easily constructed by joining several tees together. Reducing manifolds can be made by combining tees and reducers. Base fittings to fit any anchorage can be formed by welding plates to a welding fitting.

One of the base fittings illustrated was made from two standard welding ells joined to a fabricated base by welding. Another of the illustrations shows how a very rigid base fitting was made by combining a channel and angles to a reducer.

Welding in Valve Manufacture

Welding in the manufacture of valves for high pressures and temperatures was the subject of W. F. Crawford[6] and L. H. Carr.[7] At the present time, welding is utilized in the following details of valve design and construction: welding ends, welded-in or integral hard surfaced seats, seat lugs, fabricated bodies, lock welds, fabricated valve disks, pistons, hard surfaced bushings and bearings, and welded valve bonnets. A valve design of screwed and welded construction first developed in 1926 has effected economy in valve manufacture and resulted in the use of tens of thousands of these valves in many different industries, they stated. The paper described various valve welding processes, properties of metals, and various properties of weld metal. The authors concluded by saying that valve manufacturers whose products operate effectively not only at high pressures but at temperatures varying from minus 100 F to 1300 F must constantly engage in comprehensive design and metallurgical research. That welding is so widely used in the valve industry "is striking proof of its soundness as a modern manufacturing process."

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[5] Vice-president, Taylor Forge & Pipe Works.

[6] Vice-president, Edward Valve & Mfg. Co., Inc.

[7] Research Metallurgist, Edward Valve & Mfg. Co., Inc.

Corrosion in Steam Heating Systems

Methods of Reducing Corrosion Troubles

By Leo F. Collins[*] with Everette L. Henderson[†]

WITH regard to the general problem of correcting corrosion troubles, it should be remembered that no "cure-all" expedients are known. So long as present methods are employed for generating and using steam, and conventional standards of heating system construction are retained, occasional corrosion annoyances are bound to be encountered; much more can be done, however, to reduce corrosion troubles than heretofore has been considered feasible. It is the purpose of this section to review a number of experiments bearing upon this point.

The expedients which have been given careful thought are:

1) A chemical method for removing deposits from plugged lines and a mechanical method for cleaning radiators to prevent accumulation of insoluble products formed therein.

2) The use of inhibitors added to steam, and protective coatings for pipe surfaces.

3) The use of a metal, particularly in those lines handling freshly formed condensate (run-outs) which is truly resistant to carbonic acid corrosion.

4) Possible refinements in heating system construction to minimize infiltration of air.

5) Methods for eliminating deleterious gases from steam.

Freeing Plugged Pipes with Chemical Solvent

When inaccessible water lines become plugged with corrosion products or scale or both, it has been demonstrated[6] they may be cleaned by using a chemical solvent. There seems to be no logical reason for supposing that comparable results cannot be obtained in plugged condensate lines by using the same general method. In adopting the procedure, however, it is necessary that appropriate modifications be made as circumstances dictate.[**] In this regard there is one important difference between water and condensate lines. In the former case the lines are plugged (or partially plugged, at least) over their entire length, whereas heating lines are plugged only at certain places. Most often this occurs in branch return lines; indeed, it is unusual for plugging to occur in main return risers.

General Technique—The general technique followed in water lines is to introduce into the lower end of the pipe a chemical solution which will dissolve the corrosion products, and thereafter to wash the line thoroughly with water. The line is filled from the bottom to minimize the possibility of loose chunks falling down and restricting passage of the solvent.

In preparing a rust solvent, commercial hydrochloric (muriatic) acid may be mixed with an equal volume of hot water. The water used should be at a temperature of from 160 F to 200 F so that when the cold acid is added the resultant solution will be at a temperature between 130 F and 150 F. The acid and water should be thoroughly mixed, after which the inhibitor should be added and the solution stirred. Since commercial hydrochloric acid is a solution containing about 32 per cent hydrochloric acid gas in water, and since such a solution is diluted with an equal volume of water, the solution used for cleaning will contain approximately 16 per cent acid.

A number of commercial inhibitors are available. The effectiveness of the inhibitor selected should be determined by a preliminary test before an actual cleaning is attempted. This may be done by adding varying amounts of the inhibitor to a small quantity of the rust solvent of proper concentration and at the proper temperature and subsequently injecting into it small pieces of iron or steel. By noting the surfaces of the metal it can be determined which concentration of inhibitor prevents the formation of gas bubbles. The evolution of gas (hydrogen) should be practically zero.

Vacuum Cleaning Radiators

A prevalent corrosion nuisance is the plugging of return lines from cast iron radiators. This is due both to corrosion products formed and to foreign materials loosened during operation. Much trouble from this source can be avoided if new radiators are cleaned before installation.

A practical method for removing loose products from installed radiators is shown by Fig. 11. A notched nozzle made of ¼ in. pipe is connected to the top of a closed

Methods of reducing corrosion troubles in steam heating systems are discussed this month, including the freeing of plugged pipes with a chemical solvent, vacuum cleaning radiators, the use of corrosion inhibitors, and possible changes in heating system construction. . . . The comprehensive treatment of heating system corrosion, of which this month's discussion is a part, is based upon 15 years of research work for The Detroit Edison Co. Engineers concerned with operation and maintenance of building heating systems, district heating engineers, and industrial piping engineers will find the information as useful as will designers and installers of heating plants. . . . Because of its length it is necessary to publish this material in serial form; accordingly, the reader is cautioned not to pass final judgment on any statement or data until its publication is completed

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[*] Chemist, The Detroit Edison Co.

[†] Professor of Chemistry, University of Detroit.

[**] Whenever a line can be removed with a reasonable amount of trouble it is advisable to replace it or to clean it mechanically.

[6] E. L. Chappell, *Domestic Engineering*, November 2, 1929.

Part 4. Part 1 was published in HEATING, PIPING AND AIR CONDITIONING, September, 1939, pp. 539-542; Part 2 in October, pp. 620-622; and Part 3 in November, pp. 675-677.

Table 4—Data on Vacuum Cleaning of Cast Iron Radiators

Building Number	Number of Radiators Cleaned	Vacuum Employed In. Hg (Approx.)	Cu In. Dirt Removed per Radiator
11	720	5	6
3	422	5	6
5	800	5	Not known
S12	115	5	12

vessel by means of thick walled (vacuum) rubber tubing. Another opening in the dirt reservoir is similarly attached to either a vacuum pump or to the vacuum return system. A small supply of water is periodically introduced into the steam inlet of the radiator. The nozzle is scraped along the bottom of the radiator. This mechanical scraping in the presence of water and under vacuum conditions quite thoroughly removes the bothersome deposits.

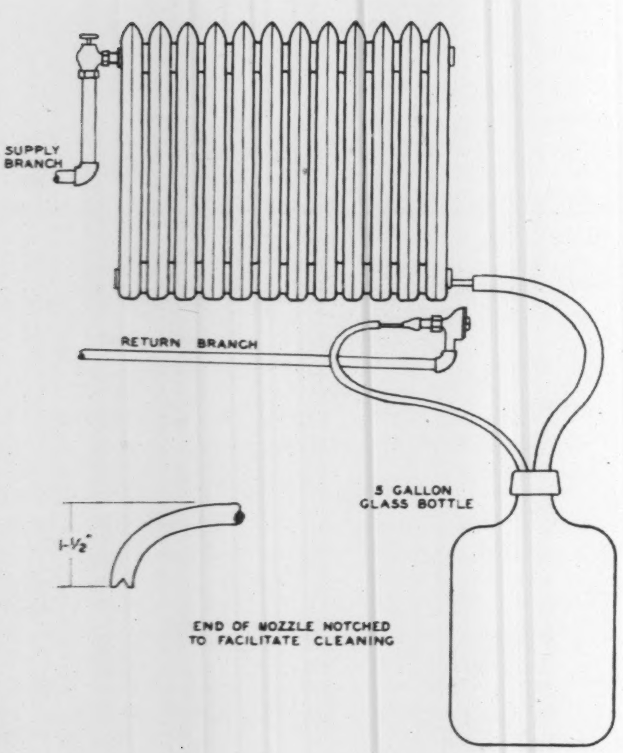
It is known that about 2000 radiators have been cleaned by this method in four different buildings. Table 4 shows the vacuum employed and the approximate volume of material removed per radiator.

It is reported that in three of these buildings little or no trouble from plugged radiator returns has been experienced since cleaning. In Building S12 a considerable number of run-outs became plugged about three years after the first cleaning. In a few cases where attempts were made to flush out the dirt with a pressure hose indifferent results were obtained.

Studies with Inhibitors

Corrosion inhibitors may be more or less of a permanent nature, such as galvanizing, cement lining, or vitreous lining, or they may require constant renewal, as is the case with oil or sodium silicate. The chief difficulty attending the use of mobile inhibitors is in obtaining a complete covering of the surface and the consequent danger of intensified local action at uncovered points. Furthermore, it has not yet been determined how far these inhibitors will be carried by steam and how thoroughly they are spread over the pipe surfaces. The ideal inhibitor is one that will volatilize with the steam, and condense with the condensate. The closest approach to this seems to be ammonia.

Fig. 11—Radiator cleaning equipment



Ammonia—Some tests have been conducted to determine the feasibility of injecting ammonia into heating systems. The theory underlying the use of ammonia is that the chemical reactions that ensue between ammonia and water will increase the hydroxyl ion concentration of the condensate and thus thwart the dissolution of iron. If enough could be injected into a steam supply to maintain an optimum pH value, and if at the same time other complications could be avoided, the expedient would be feasible.

Table 5—Data Collected When Injecting Ammonia Into an Operating Heating System Containing 6700 Sq Ft of Radiation[a]

Time, Hr	Total Lb Condensate Treated	Total Lb NH_3 Added (Cumulative)	pH Value
0.0	0	0.00	5.4
0.5	200	0.50	5.4
1.0	400	0.75	5.4
1.5	600	1.00	5.6
2.0	800	1.13	8.8
2.5	1000	1.25	9.3[b]
3.0	1200	1.38	9.6
3.5	1400	1.44	9.7
4.0	1600	1.50	9.7
4.5	1700	1.50[c]	9.7

[a] Building No. S3.

[b] Condensate began to exhibit a faint odor of ammonia.

[c] Discontinued feeding ammonia at this time, and after 16 hr had elapsed pH value of condensate was 8.0.

A laboratory test conducted by Speller[7] in a closed heating system demonstrated that a pH of 8.4 to 9.0 could be maintained for over two years with one addition of ammonia. Within this range no action was noted to occur on brass parts, but it is Speller's belief that higher concentrations would be injurious to copper alloys.

A field test was made in a building having a low vacuum heating system and containing 6700 sq ft of connected radiation. A weighed amount of ammonia gas was injected continuously into the main steam header, and pH measurements were made on condensate discharged from the meter. Data for the test are shown in Table 5.

When a consistent pH of 9.7 was maintained the steam showed an ammonia odor and the condensate had a very putrid taste.

At the time these tests were conducted the influence of carbon dioxide in promoting corrosion was not well understood. It was our belief that oxygen alone was a matter of concern. The critical pH value for oxygen corrosion is about 9.6. Accordingly it was our opinion that if ammonia were effective the hydroxyl ion concentration would have to approximate pH 9.6. It is now known that carbon dioxide causes severe attack and that its action ceases at about pH 5.9. If this be true, then it is evident that for ammonia to be effective only enough must be added to raise the pH value to approximately 6.0. In the great majority of cases the pH value of condensates is never lower than 5.0, and it can be shown that an extremely small amount of ammonia is needed to raise the pH value of a condensate from 5.0 to 6.0. The expedient, therefore, has possibilities, but the practice should be inaugurated with care. Accumulation of the gas may cause serious corrosion of brass parts.

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[7] Report of sub-committee on corrosion, NDHA *Proceedings*, Vol. 24, 1933.

Oil and Sodium Silicate—If dissolved gases are the basic causes of corrosion, then it follows that if the contaminated water can be kept from contact with pipe surfaces, no corrosion will occur. Theoretically this may be accomplished by introducing into condensate lines suitable materials which form protective films. Two materials reputed to have this characteristic are oil and sodium silicate. The "oiling" of steam to inhibit corrosion has been advocated heretofore, but measurements of its effectiveness have never (to our knowledge) been made. During these studies, tests were conducted in two buildings, each having a different type of heating system. In each building three separate vertical return risers were selected and in each line a corrosion tester was placed. No inhibitor was fed into the first riser, oil was fed into the second, and sodium silicate into the third. The comparative corrosion rates measured under these conditions are shown in Fig. 12.

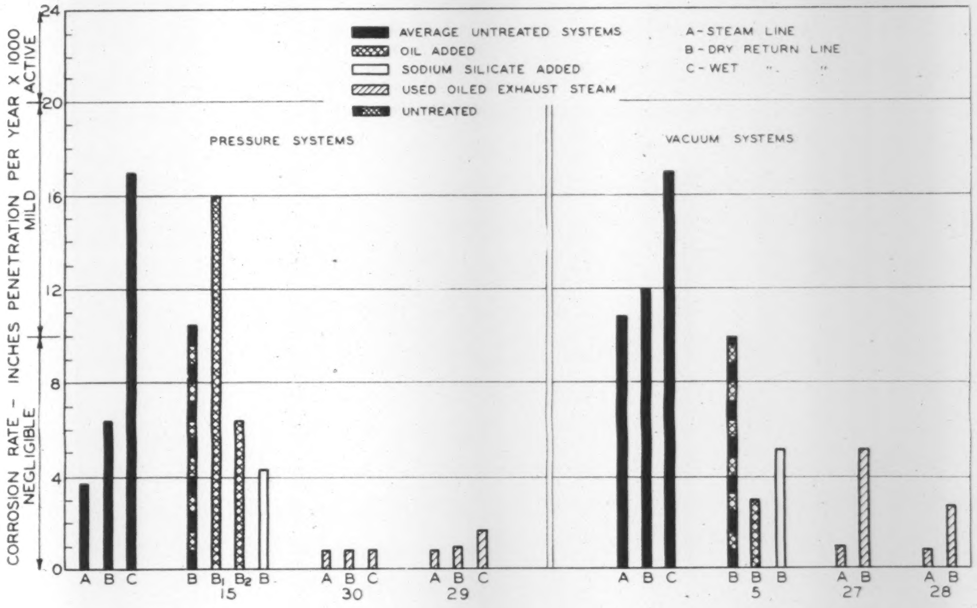

Fig. 12—Effectiveness of oil and sodium silicate in mitigating corrosion

It will be noted that in Building 5, having a vacuum system, both inhibitors were effective, but in Building 15, having a pressure system, a decrease in corrosion was produced in the pipe in which sodium silicate was fed, but in the oil treated riser, shown by bar B_1 the test specimen experienced an increased activity.

In all cases the inhibitors were fed at a location where it was thought the velocities were sufficient to carry all the inhibitor past the point where the corrosion tester was situated. In Building 5 this occurred, but in the oil fed line of Building 15, considerable condensate fell to the bottom of the riser where it was trapped off, taking along its quota of oil. Moreover in Building 5 one gallon of oil was fed, whereas only one-half pint of oil was introduced at Building 15 during the 28 day test period. This—and the peculiarity of the system design—readily account for the lack of any visual evidence of oil in Building 15, and for the high corrosion rate, as compared with the unmistakable evidence of oil in Building 5 and its corresponding low corrosion rate. These data also substantiate the contentions that the presence of insufficient inhibitor may increase the rate of attack, and that the effectiveness of oil depends upon its ability to form a protective coating. The latter is formed only when an ample quantity is fed and properly distributed. In Building 15 the test was repeated, using considerably more oil. This proved to be effective, as is denoted by bar B_2 in Fig. 12.

There has long been a feeling (not, however, based upon actual measurements) that corrosion is less serious in heating systems supplied with exhaust steam from reciprocating engines, which contain more or less oil, than it is in systems supplied with live steam. That the oil so entrained finds its way into the heating system has been well established, but its effectiveness has never been measured, as far as we know. In this investigation an opportunity was afforded to study four such systems. The corrosion rates measured compare favorably with the data obtained when oil was deliberately introduced. These results are also shown in Fig. 12. All the values for "oiled" steam, upon comparison with corresponding average values for clean steam for the same type of system, certainly indicate that oil is an effective inhibitor.

The use of sodium silicate and oil calls for further study before they can be definitely recommended. Considerations other than corrosion prevention are involved. For example, the presence of either might prove embarrassing if the steam is used in open cookers, in clothes pressing machines, and in sterilizers. Furthermore, considerable difficulty might be experienced in removing either from the condensate if the latter is used as boiler feedwater. Their removal is *imperative* from the point of view of good boiler operation.

In the case of sodium silicate it is not known whether its protection is due to its ability to increase the pH value, its reputed ability to form a protective coating, or both.

Changes in Heating System Construction

Our analyses of steams and condensates unmistakably indicate that oxygen dissolved in the condensate in the average heating system is due chiefly to inleakage. Although inleakage is the result of imperfect construction it is probably not entirely preventable with present commercial piping materials or conventional methods of construction. It most certainly can be reduced, however, by substituting welded for screwed joints and by refinements in the construction of joints between the body and cover of thermostatic traps, the stuffing boxes of packed valves, the joints of packless valves, and in expansion joints of the corrugated or packed type. This is especially true when they are employed in systems which operate intermittently or under vacuum.

To advocate the discontinuance of vacuum systems, and the intermittent operation of pressure systems as a corrosion prevention expedient, are not indicated by the data and are not justifiable on the basis of over-all considerations. In brief, the reasons are:

1) Oxygen apparently causes few pipe failures.

2) Such operation tends to purge the system of accumulated carbon dioxide and thereby thwarts acid corrosion.

3) The economies in heat utilization so effected far outbalance the normal cost of corrosion so occasioned.

The length of time that the condensate is in contact with pipe walls also affects the rate of corrosion. It follows, therefore, that the corrosion rate in horizontal return lines should be more severe than in vertical lines in the same heating system. Thus it would seem that to minimize failures at such locations the use of extra heavy piping would be a practical expedient. The desirability of eliminating wet return lines is also indicated and the necessity for elimination of small lines, which are easily plugged with corrosion products, is obvious. The necessity for eliminating "dead ends" in distribution mains has been shown heretofore by the work of Hayes et al.[8]

Rather recently it has been deemed desirable to construct some heating systems so they can be used, in part, for summer cooling as well as for heating. The scheme followed is to provide ducts through which air is circulated throughout the building. The heat transfer equipment is usually situated in the basement.

The air is heated by passing over fin type coils and the latter are constructed of non-ferrous metals. Large amounts of steam are rapidly condensed and the equipment operates continuously for long periods. When a CO_2 laden steam is used, such practice causes considerable gas to accumulate in the condensing equipment and a proportionate amount to dissolve in the condensate. All of these conditions conspire to accelerate acid corrosion. The branch return line from such equipment is subject to rapid corrosion.

Whether or not such equipment can be adequately vented depends upon the particular arrangement of the equipment. For this reason, no general rules can be given. Replacing the return lines with corrosion resistant piping is not a cure-all, for this may merely transfer the trouble farther downstream in the system.

[*To be continued*]

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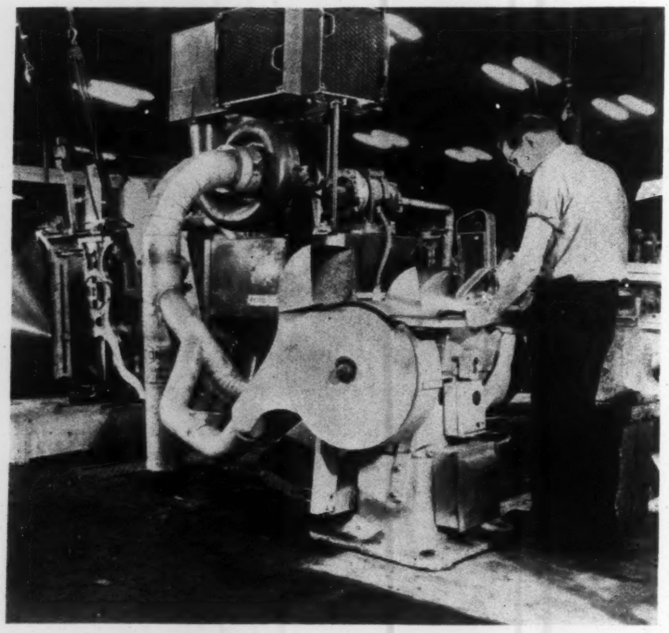
[8] A. Hayes, E. L. Henderson, and C. E. Staneart, *Bulletin No. 84*, Engineering Experiment Station, Iowa State College, 1927.

Air Conditioning as Production Tool

[*Concluded from p. 731*]

The photo-electric beam of light on the scale when intercepted and when again permitted to enter the photo-electric cell operates relay circuits. In the case of weighing a liquid from a tank into a scale tank the circuits open and close solenoid supply and discharge valves. The supply valves are double orifice valves, having a large supply orifice for speed, which is the first one shut off by the interception of the eye and then a small dribble orifice continues to drop a pencil stream of the liquid into the scale tank until the exact weight is in the tank, when the intercepting shutter of the scale again releases the beam of light, which immediately closes this dribble orifice. After a few seconds delay the discharge valve from the tank automatically opens and the weighed liquid drains from the tank through the pre-set lines to tanks on the floor below. When the scale tank is empty and the intercepting arm has gone back to its original position the discharge valve automatically closes. In other words, even though the operator had walked the floor with a colicky child the night before he cannot omit or put in too much or too little of any ingredient in the tank, nor can he forget to close the discharge valve so that when he would start weighing up another batch he would be running it through the scale tank instead of weighing it in the scale tank.

With hundreds of grinding wheels in operation at the Simonds plant, it is necessary to keep dust particles under control at their sources. The air is filtered and recirculated by units like these, from which underfloor ducts lead to different machine locations



Possible temporary interruptions of electrical service in no way disrupt these operations. The solenoid valves are normally closed valves, and must have energy to stay open. When electrical service is interrupted and the sequence of batching operations stopped, all valves close. When the electrical service is re-established, then automatically the processing batching operations start again at the point at which the interruption occurred and full automatic control is continued.

Following these pre-mix batching operations, batches are delivered to storage tanks from which they are automatically released for the further injection of other ingredients, agitation, milling, filtering and similar processing operations.

Air Conditioning's Many Uses Are Discussed at Eastern Conference

....hotels, hospitals, schools and blast furnaces get attention at Lehigh conference

MANY of the applications of air conditioning were discussed at the eastern air conditioning conference held last month at Lehigh University, Bethlehem, Pa. The program included papers on air conditioning for hotel guest rooms, hospitals, an educational building, and for cold storage, with discussions on refrigeration storage, climate, creating a demand for air conditioning, the quality of air, and moisture removal from blast furnace air.

The conference was sponsored by the American Society of Refrigerating Engineers, the Philadelphia chapter of the American Society of Heating and Ventilating Engineers, and the Air Conditioning Manufacturers' Association. Prof. B. H. Jennings was the conference committee chairman.

Tremendous But Gradual Growth

In his opening remarks, A. R. Stevenson, Jr.,[1] warned that "we can't go out tomorrow and multiply the total air conditioning business by 10, any more than it was done or could be done in any of the other great industries." He emphasized that in general it has been the trivial fads that have mushroomed overnight, while the worthwhile enterprises have grown more slowly and steadily. "It is correct to visualize a tremendous growth in air conditioning," he stated, "but it will be a more gradual, healthy development than is sometimes anticipated. There is a certain law of gradualness, and the more worthwhile a thing is, the longer it may take to mature. Thus far the potentialities have scarcely been scratched. As more and more potential customers realize the values of air conditioning, we may expect rapidly increasing markets."

Blast Furnace Air Conditioning

Increase of output, lower consumption of fuel and greater uniformity of product were cited by L. Logan Lewis[2] as the principal advantages of blast furnace air conditioning. In addition, the blast furnace superintendent need no longer be a weather prophet. Mr. Lewis told the story and results to date of the air conditioning plant recently installed at the Woodward Iron Co. plant near Birmingham, Ala.

On a maximum day, he said, the Woodward dry blast plant prevents more than 30 tons of water from entering the furnace. Lowering moisture in the blast reduced the amount of coke which must be burned for each ton of iron produced and increases the total output which can be obtained from a furnace.

In reviewing the history of "dry blast," he pointed out that attempts to apply this principle to blast furnace usage were made as early as 1880 with calcium chloride, sulphuric acid and other chemicals. However, it was not until 1890 when James Gayley began his experiments with refrigeration that the present method began to take shape. Accounts of an early installation, Mr. Lewis explained, reported material saving in coal and contained the following significant statement: "It had been admitted by nearly all metallurgists that there were great advantages in having dry blast. Not only did one get decreased fuel consumption, but one got what was almost of greater importance—greater uniformity of product."

A modern installation was recently made at the Woodward iron works, he added. The furnace is a medium sized one, having an output of 400 to 550 tons per day of merchant iron (pig) on a metallic yield of approximately 36 per cent. The wind required is 45,000 to 50,000 cfm. A moderate dew point of 40 F (slightly less than 3 gr per cu ft) was selected as the most practical. Refrigeration is supplied by a turbine-driven centrifugal machine, doing 520 tons of work in cooling 1200 gpm of water.

Water removal is accomplished by cooling and condensing with direct sprays on the suction side of the blowing engines. Outside air is drawn in through the intake stack and carried from the dew point chamber to the blowing engines by a round duct. The dehumidifier is two stage with partial elimination between stages. The water is pumped from the sump of the second air stage to the sprays of the first air stage and then from the sump of the first air stage back through the refrigerating machine.

The dry blast plant was put in operation in the latter part of June. The response of the furnace to drier wind was immediate and impressive. Burden was promptly increased. A noteworthy reduction in coke per ton of iron followed promptly and the silicon content of the iron also responded to the lowered moisture content.

Of quantities involved, Mr. Lewis said, the normal wind required in the Woodward furnace amounts to 2700 net tons of air per day or 5.6 tons of air per ton of iron. Each grain per cfm means a little more than 5 net tons of water per day.

A booklet containing the complete papers presented at the eastern air conditioning conference held at Lehigh University, November 10-11, 1939, is available at 50c from the department of mechanical engineering, Lehigh University, Bethlehem, Pa.

[1] General Electric Co.

[2] Vice-president, Carrier Corp.

Without dry blast, variations in moisture content weather are fought (by some) by varying the temperature of the hot blast, he explained. General practice in this respect is to allow 25 to 50 F for each grain per cu ft of free air. This is an appreciable item in the heat balance. It requires that reserve capacity be left in the stoves in anticipation of sudden rises; and that with rapidly falling dew points, the temperature of the blast must be depressed below this practical maximum.

Since the charge is introduced some 10 to 12 hr before it reaches the hearth, weather must either be accurately predicted hours in advance or ample leeway left in hot blast temperature for the purpose of keeping the furnace regular until the burden can be changed to conform to whatever weather is expected at the end of the 12 to 18 hr.

Lowering moisture in the blast reduced the amount of coke which must be burned for each ton of iron produced, and increases the total output which can be obtained from a furnace. One grain per cubic foot accounts for about 48 lb of coke per ton of iron; a little more than six grains, therefore, about 300 lb of coke per ton of iron.

This tangible, plus that of increased production, is of at least sufficient magnitude to cover more than the operating and maintenance costs of the dry blast plant, he concluded. Of vital interest to all, therefore, is the value of the "velvet" in the form of such intangibles as regularity and the power to produce at will the quality or kind of iron desired free from kish and scruff and to hold these qualities within narrow limits.

Hotel Guest Room Air Conditioning

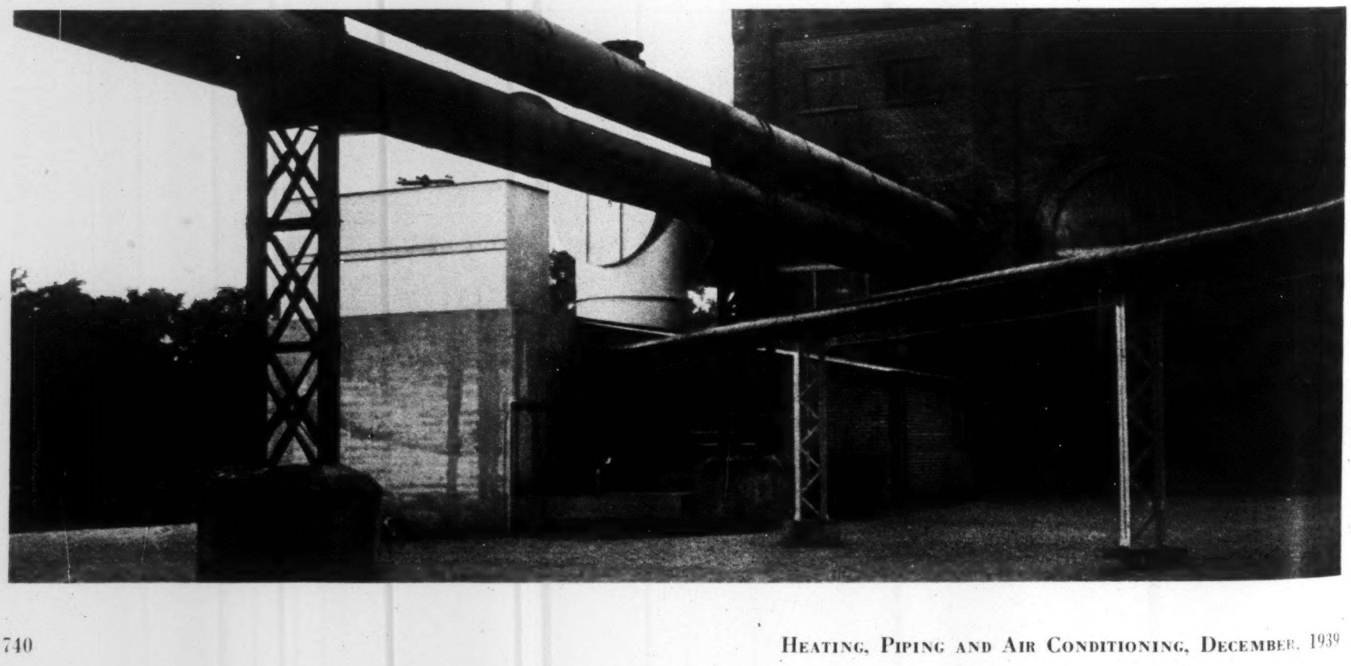
John Hertzler[3] discussed the general question of hotel guest room air conditioning and presented an analysis and details of installations in eight different hotels; a summary of the data is given in Table 1.

He said there are several factors involved. Competition for popular favor seems at present to create a demand by hotels for something different, so that one will want an inconspicuous system and another will desire some mechanical gadget mounted for the occupant in each room; sales considerations of this kind constitute the first element governing the design of the air conditioning. The second element in design is the construction of the building. Possibly too extensive alterations will be required for a central station system. The height of corridors may determine whether ducts can be run from a central station to all rooms on each floor, etc. The third consideration is the kind of energy available and economically justifiable for air conditioning. In a natural gas region, for example, it might be wise to use gas. Hotels make various uses of power and heat, and thus it will pay to make a complete heat balance study to determine whether the air conditioning system should use electrical power, exhaust steam, low pressure steam from a heating boiler, or diesel power. Finally, good design requires the operating characteristics of the air conditioning apparatus to be taken into consideration. Noise level as measured in the guest room is of extreme importance.

He stated that the following types of systems have been used in hotels: (1) Self-contained units of the plug-in type, air cooled and installed in outside windows. (2) Units of either the ceiling mounted or enclosed radiator type, each with a circulating fan and motor, cooling coil, air filter and drip pan with connections. (3) Unit air conditioners used as modified central stations to take care of smaller wings of buildings or separate floors. (4) Central station air conditioning systems, either with air washers or finned coil banks. (5) Combination cooling and dehumidifying systems, chemical adsorption being used for dehumidifying part of the air provided by a central plant.

Where large numbers of rooms have been air conditioned at one time, the systems installed have been of the central station type, he said, and unit systems have been used where isolated rooms were provided as an optional service.

In the detailed studies he gave, which are summarized in Table 1, corridors, bathrooms, and closet space have not been considered. The corridors would, however, be



Concrete encased spray dehumidifier at Woodward iron works. Outside air is taken in through a stack rising from end of spray chamber

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[3] General Representative, York Ice Machinery Corp.

Table 1—Summary of Data on Hotel Guest Room Air Conditioning

Hotel and City	Mayflower, Washington	St. Anthony, San Antonio	New Monteleone, New Orleans	Pickwick, Kansas City	Del Sol, Yuma	Heidelberg, Jackson, Miss.	Ben Milam, Houston	Beaumont, Beaumont
Total guest rooms conditioned	235	450	44	120	70	136	250	210
Number of guest floors conditioned	5	7	4	4	2	6	9	9
Outside air design conditions, dry bulb and wet bulb	95–78	95–77	95–78	95–78	115–76	95–78	95–77	100–78
Inside air design conditions, dry bulb and relative humidity	80–50	80–50	80–50	80–50	80–45	80–50	80–50	78–50
Conditioned floor area, sq ft	41,380	117,615	8,990	34,800	18,900	36,950	72,000	59,980
Conditioned room volume, cu ft	372,420	1,117,346	94,395	348,000	170,000	379,840	648,000	543,130
Number of people	375	872	88	160	100	268	504	302
Floor area per person, sq ft	110.3	135	102	218	189	138	143	198.6
Watts of light	21,000	95,970	4,400	16,000	2,000	13,400	50,400	37,400
Watts per sq ft floor area, avg	0.507	0.816	0.49	0.46	0.116	0.363	0.70	0.624
Minimum outside air, cfm	15,000	18,000	2,860	6,000	4,000	6,000	10,000	7,596
Minimum outside air, cfm per person	40	20.6	32.5	37.5	40	22.4	19.83	25.2
Minimum outside air changes per hr	2.42	0.97	1.82	1.03	1.41	0.95	0.925	0.84
Internal sensible tons	61.46	134.40	18.647	39.2	29.0	45.170	74.040	59.36
Internal latent tons	4.75	11.34	1.122	12.4	1.6	3.424	6.435	7.73
Total internal tons	66.21	145.74	19.769	51.6	30.6	48.594	80.475	67.09
Total internal tons ÷ internal sensible tons	1.08	1.085	1.06	1.32	1.05	1.075	1.087	1.13
Circulated air, cfm	57,900	93,460	8,830	28,600	17,500	24,500	45,000	36,900
Cfm per sq ft floor area, avg	1.40	0.795	0.983	0.82	0.93	0.663	0.625	0.615
Circulated air changes, minutes avg	6.43	11.95	10.7	12.2	9.71	15.5	14.4	14.7
Total tons refrigeration required	125.0	222.7	30.49	66.82	32.7	76.69	120.0	99.0
Volume per ton, cu ft	2,980	5,000	3,090	5,210	5,200	4,950	5,400	5,480
Floor area per ton, sq ft	331	528	295	521	578	481	600	605

cooled to approximately the same temperature as the guest rooms if they were used for the purpose of returning air.

In concluding, Mr. Hertzler remarked that the first hotel to provide air conditioning in a given locality will receive more rapid return on its investment than will the last. A time might be reached when air conditioning in competitive hotels in a given locality might force the hand of a non-air conditioned hotel as a self-preservation measure. He said that in a southwestern city, a small hotel increased its revenue materially by installing air conditioning and ultimately raising its rates. It forced larger competitive hotels in the same city to install air conditioning principally by virtue of its competitive influence.

Air Conditioning an Educational Building

Samuel R. Lewis[4] presented a discussion of the complete air conditioning of an educational building. Although there are as yet very few school buildings with year around air conditioning; many colleges operate summer schools—and there are some private schools, such as business colleges—in which provision of comfortable working conditions is eminently justified during the hot months. He said that it is evident that a successful year around air conditioning plant must be able to provide enough controlled income or outgo of heat for every room during any hour of any season to balance the uncontrolled heat losses or gains, even though the uncontrolled part of the income or outgo of each room varies constantly and will be different for every room in the same building at any given moment. This balancing of the "budget" may be accomplished in many ways.

One way of heating and ventilating school buildings in winter is by use of the all-blast system. Two temperatures of air supply are provided, one for heating which is always kept warmer than the room temperature desired, and one for cooling after heating, not more than about 8 deg cooler than the room temperature desired. Another method of heating and ventilating school buildings in the winter is by the split system, enough direct radiation being placed in the room to heat it, and the air for ventilation not being used for heating the room but being delivered to all rooms at the same constant volume and constant temperature—usually very slightly cooler than the desired room temperature. Many school buildings have unit ventilating machines which, if successful, must each have an individual thermostat in the delivery air way which manipulates a double damper so as to mix heated air with unheated air and thus brings about a delivery temperature varying from considerably warmer than the desired room condition to a very few degrees cooler than the desired room condition. Year around air conditioning has been accomplished quite satisfactorily with unit machines employing hot water in winter and chilled water in summer, pumped through the same copper piping and convectors for both services.

He then outlined the features of several year around air conditioned educational buildings. These include, briefly, two separate air supply systems, each with its individual and correlated exhaust fan, one system serving the class rooms and the other the auditorium. Separate air supply and exhaust systems for the auditorium permit its independent operation and prevent wasteful heating and cooling of a room which may be unoccupied during many hours while class rooms are occupied. Heating is accomplished by steam in cast iron prime surface convectors and cooling by separate chilled water copper fin convectors. Ducts are insulated in all locations where the ambient air can circulate around them. At the base of each separate branch riser serving a single room a copper finned duct reheater is provided, controlled by a thermostat in the room it serves. Control of relative humidity in summer becomes easy when reheaters are available and it is possible with such a system to take care of the condition occurring in late spring and early fall when heating may be necessary in the early morning hours but cooling becomes desirable in the afternoon.

In two large educational buildings on the same campus, refrigeration power is obtained by low pressure condensing turbines and the exhaust steam from these is condensed by the water which condenses the refrigerant. The condenser water is pumped to an induced draft cooling tower in the attic, and the condensate is returned to the central boiler plant serving the campus.

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[4] Consulting Mechanical Engineer. Member of Board of Consulting and Contributing Editors.

Hospital Air Conditioning

When new hospitals are being planned, or old buildings remodelled, there is almost invariably a call for air conditioning, said Charles F. Neergaard[5] in his paper on the realistic approach to hospital air conditioning. To reach any definite conclusions as to the soundness of general adoption of hospital air conditioning, it is necessary to weigh and relate five different angles and interests—the public health expert, the clinician and surgeon, the research engineer, the consulting engineer, and the operating engineer. Aside from its benefits to premature infants and to hay fever and pollen asthma patients, evidence of the clinical value of air conditioning to the general run of hospital patients is as yet "not proven" so far as he has been able to discover. Some 250 hospitals have installed air conditioning, mostly limited to a few departments, but their reported experience deals chiefly with comfort.

He said that engineering practice in hospitals is far from standardized. While the cost per bed is not an exact yardstick, it is suggestive that the investment in heating and ventilating plants in a number of hospitals has ranged from $350 to $600 or more per bed. The few available figures on air conditioning costs show an even wider spread; estimates for year around conditioning for the essential sections of one building now under construction ran $200 a bed, whereas another, now finished, reports $433.

Mr. Neergaard said that aside from systems of panel heating, which most nearly conform to the ideals of the physiologists, the satisfactory heat for hospitals is, in his opinion, circulating hot water, because of its flexibility, simple control, low temperature and economy. When it comes to cooling, the most economical method would appear to be to a layman, at least, to pump cold water through the heating piping and radiators instead of using air ducts. The insulation of a building against heat loss presents great possibility of economy and when summer cooling is installed, insulation is doubly important.

Mr. Neergaard concluded his paper by saying the hospital is keenly interested in the possibilities of air conditioning and in the studies of the physiologists and engineers who are developing and perfecting it. To accept it as a hospital essential, however, it is necessary that more factual data on clinical values be secured. He expressed the hope that facilities for special research may be liberally underwritten to determine its application to the treatment of disease, and said these facilities should be organized, centralized and financed essentially as research, as the nation's hospital costs are already too high to warrant promiscuous experimentation. He said that from a financial standpoint, it would appear that general air conditioning may be wisely limited to operating and recovery rooms, delivery rooms and nurseries, and that portable air conditioners be made available for patients who need them to promote recovery, or who can afford to pay extra for comfort.

Uses of Air Conditioning in Hospitals

Dr. Murray B. Ferderber of the University of Pittsburgh school of medicine discussed the uses of air conditioning in hospitals:

The physiological effects on persons exposed to various environmental conditions are subject to controversy despite the fact that such investigations have been under way for many years. It is reasonable to assume that hospitals should be given consideration, because we are concerned there with pathologic persons. One of the most outstanding uses for conditioning may be found in operating and recovery rooms where not only the operating personnel derives benefits, but also the patient whose health must be regarded with the utmost care. It has apparently been the practice of many institutions to condition only the operating room, but it is Dr. Ferderber's opinion that the short time spent here does not compare with the longer period which the patient must undergo during convalescence. It has been indicated that the many advantages to the operating personnel are parallel to the ease of convalescence of the patient in the recovery room, because in the latter the elimination of passage through halls and elevators of different temperatures prevents complications which commonly follow operations. The findings of this investigation would tend to refute the fear of extreme lowering of body temperatures under anesthesia since no gradient greater than $\frac{4}{5}$ F was found during the period of operation. The use of bactericidal radiant energy has received popular acclaim for sterilizing the air chiefly over the field of operation to prevent infecting of surgical wounds, etc. The work of Wells would indicate the need for some sterilization since the facts regarding droplet infection are no longer mysterious.

In 1933 Drinker, Yaglou, and Blackfan developed the formula that approximate required humidity and temperature regulation were vital in reducing the mortality of premature infants. An average of 77 F and 65 per cent relative humidity in the nursery not only reduced the early physiologic weight loss but lessened the mortality from 28 to 0.7 per cent for all causes. To maintain uniformity of temperature in extreme weather and to remove odors, 15 to 25 air changes were necessary with less than 20 fpm.

Another valuable use for air conditioning which has been neglected is in the diagnosis and treatment of peripheral vascular diseases. A constant temperature room between 75 and 80 F and a relative humidity of about 50 per cent is quite necessary to establish an equilibrium between the circulation of the parts and the environment. In order successfully to treat such patients, higher temperatures and yet unknown humidities are very necessary because not only must comfort be considered but the temperature range is of extreme importance. Such an investigation is now under way. In addition heat must be supplied to many such individuals while they are bedridden and as heating and ventilating engineers we have done little to improve on the age old "radiant heat cradle." It is not too inconceivable to believe that we may be able to develop hospital departments where patients might live during the colder, inclement months who might otherwise go to warmer climates to avoid the rigors of winter. After all, we can condition such enclosures to simulate warm weather, we can expose these patients to sufficient ultraviolet radiation, and above all comforts could be provided so that the air of hospitalization would be almost entirely eliminated.

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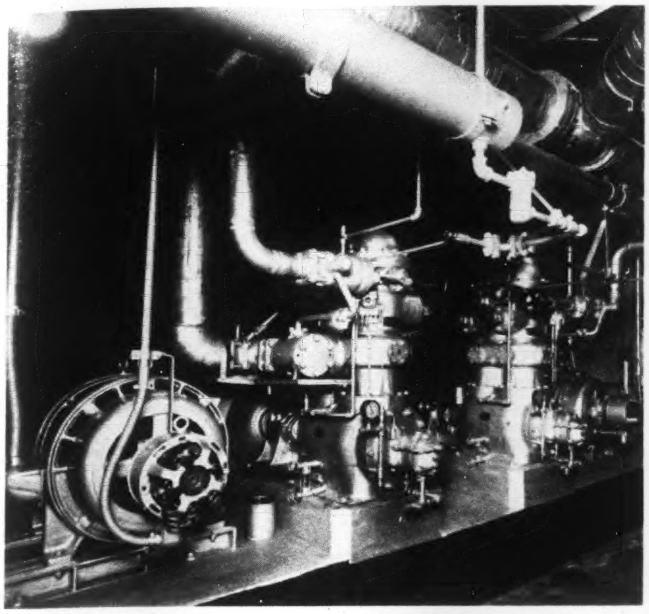
[5] Hospital Consultant.

Fever therapy is extensively used in hospitals throughout this country and many methods of creating artificial fever have been devised, ranging from the ancient baths of the Romans and Japanese down to the present time where air conditioning has played a very important part. Such an apparatus which seems to meet the requirements of safety and simplicity was devised a few years ago by Houghten, Gutberlet, and Ferderber. Instead of elevating the temperature by electric induction, saturated atmospheres are utilized, the advantage being considerably lower dry bulb temperature to prevent burning or shocking. The campaign against the venereal diseases has further stimulated the use of fever therapy and its efficiency in treating chorea (St. Vitus dance), some forms of arthritis, etc., has been widely demonstrated. From fever therapy studies we have learned much regarding the mechanism of body regulation and its relation to high temperatures.



Central water cooling unit composed of two 75 hp reciprocating compressors at the Ben Milam hotel

A few words regarding cryotherapy are in order since this investigation has created wide comment upon its usefulness. It is entirely the opposite of fever therapy and the body temperature is lowered to 85 to 86 F, and in a few cases even lower. This resembles the state of hibernation found in certain animals during which time all body processes are at an extremely low ebb, and the patient becomes only a vegetating organism. Thus far the investigation includes the treatment of malignant tumors but the subject is too controversial and only time will prove whether it will be a valuable treatment in this or any other disease.

Allergic patients suffer greatly if the substances to which they are sensitive are not removed from their surroundings. Any system of air cleaning should be so arranged to provide for the removal of such offending agents and whether it be electrostatic precipitation or filters it must be remembered that the primary object is to prevent the admission of allergens to the enclosure where the patient lives. On the other hand some allergies result from intrinsic offenders (within the patient himself) and this mysterious condition has not been satisfactorily remedied to date.

In the treatment of pneumonia or heart disease a suitably conditioned enclosure is vital to the patient because the need of oxygen is urgent. From experience it appears that the oxygen tent is suitable. There should be a satisfactory range of conditions including 60 to 75 F, 30 to 50 per cent relative humidity, oxygen concentrations of about 50 per cent, and carbon dioxide under 1 per cent. The use of a simple nasal catheter for oxygen administration is certainly better than no oxygen.

In x-ray and physical therapy departments the presence of ozone may prove troublesome and even unpleasant. In a few institutions the tendency seems to be the use of a competent exhaust system to alleviate this condition. In contagious wards the danger of cross infection is ever present, and it appears that the use of the ultraviolet lamp for sterilization may aid materially in preventing the spread of contagion. Conditioning of such wards must be done with extreme care to prevent the complications just mentioned, according to Dr. Ferderber.

Little or no consideration has been given to living conditions of hospital personnel, including nurses, attendants, etc. In some institutions living quarters are situated over the laundry or power house where it is difficult for the worker to live in comfort. It seems plausible that the cost of making living quarters comfortable might well be balanced by the increase in efficiency during the working hours in the hospital itself.

Air as Contagion Vehicle

W. F. Wells[6] spoke on air as a vehicle of contagion and said that study of the bacterial behavior of air has revealed a mechanism of air-borne infection. Evaporation of minute droplets expelled in expiratory processes enables infection to ride these droplet nuclei on air currents. Recognition of vehicles of spread of infection leads to methods of disease prevention. Studies on prevention of contagion by the bactericidal irradiation of the air we breathe promises conclusive evidence of the importance of air as a vehicle of contagion.

Everyone is very much interested—and quite properly so—in the great achievements of air conditioning engineers, said J. L. Rosenmiller[7] in his discussion of creating a demand for air conditioning. There is an essential task to be performed, however, and that is the creation of the demand for air conditioning which is the responsibility of the sales promotion and advertising divisions of the industry. A study of the methods used by various firms reveals that their advertisements and educational programs are conducted to show that in the commercial field the following results may be expected from the purchase of air conditioning: Increased sales volume, improved employee health and efficiency, reduction in merchandise spoilage, new customers obtained.

[*Concluded on p. 745*]

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[6] Director, Laboratories for the Study of Air-Borne Infection, University of Pennsylvania, School of Medicine.

[7] Chairman, Advertising and Public Relations Subcommittee, Air Conditioning Manufacturers' Association.

Theory Needs Common Sense for Reasonable Engineering

DEXTER S. KIMBALL, one-time dean of mechanical engineering at Cornell, used to tell his students: "Check it to see if it's reasonable." They would snicker at the idea. How could an engineering result "be reasonable or unreasonable"? Engineering was a science and the results were facts.

Engineers who apply equipment to the job know what he meant. How often have you completed a calculation, possibly long and complicated, only to find the result a monstrosity? What to do? Figures don't lie, but liars can figure. Unless the result is reasonable, engineering becomes a ridiculous farce.

By Lester T. Avery*

In these provocative remarks, Mr. Avery points out that common sense as well as theory is needed for reasonable engineering, particularly in air conditioning work. Development of air conditioning along practical lines is in the hands of the designing engineer. Dealing with tangible, definite things that produce indefinite and intangible effects on people, he makes and adheres to his own standards, which must be well above the minimum. . . . Whether or not the "customer is always right" is touched upon—and some of the reasons why he isn't are given

For instance, the heat gain on the top floor of a building exposed to sun on all sides with a plain roof calculates 360,000 Btu per hr or 30 tons. With a 15 F temperature difference between the entering air and the room 22,000 cfm was required for the air cooling system. Nothing wrong with the figures or the result so the air system was designed to handle 22,000 cfm. It's tough, hard to find room for ducts, no good way of getting the air outlets located right; but never mind, "we have to have that much air." This may go on to the point of actually making the installation, and when the result is windblown and drafty everyone agrees what a hard job it was to do at all.

The volume of the conditioned space was 40,000 cu ft, there were 8 ft ceilings, and the amount of air—22,000 cfm—was "unreasonable" (less than a 2 min air change). Practically impossible to handle so much air without drafts unless perforated ceiling is used for the air inlet. So what?

Well, maybe the electric light load was added to the sun load; maybe the sun load on two sides was added instead of taking the greater; maybe the roof could be insulated or at least protected with water to minimize the sun heat; maybe awnings or outside venetian blinds or sun reflecting screens could be used. Money spent on these methods of keeping the excessive heat out might be greater than for the equivalent first cost of the extra cooling without them, but the system would become "reasonable." There is nothing difficult or mysterious about the practical application of air cooling but there are so many opportunities to readjust the engineering on a "reasonable" basis to arrive at sensible results.

Then again the calculations on a group of small private offices indicated the need for a system circulating 10,000 cfm. There were only 40 people and an allowance of 15 cfm per person indicated 600 cfm of outside air as being sufficient. But you can't do that. No recirculating system in the ordinary building with window cracks, doors and porous walls can recirculate 95 or even 90 per cent of the air. Outside air will come in regardless, so these figures are not reasonable and the outside air is increased to 1500 cfm or 15 per cent, leaving 85 per cent for recirculation. That's reasonable and it will work that way, and the 40 occupants will like the extra air.

Sometimes a restaurant kitchen is so situated that the only source of air for ventilation must come through the dining room. What difference does it make if the dining room to be cooled needs only 2000 cfm outside air if the kitchen fans are drawing 5000 cfm or more? Unless some other source is provided for the kitchen air, the cooling system will not be reasonable unless it supplies the 5000 cfm and the system is designed accordingly.

A large installation is generally a combination of a number of separate sections, separately figured and handled. The cumulation of *maximum* peaks in all these sections can be analyzed on a reasonable basis. There is a tremendous storage capacity in the building itself that helps overload peaks. A little over-capacity here may help out a little under-capacity there, but the engineering is flavored with common sense, experience and a dash of imagination.

For comfort work the engineering is predicated on the assumption that good engineering will please all the people concerned—buyer, employee and customer. These three groups have widely different viewpoints. To most buyers the first cost is of exaggerated importance. So-called competitive bidding in air conditioning *without competitive specifications* is directly responsible for most of the poor installations. No matter how close one figures the load, how little outside air is provided for ventilation, how few precautions are taken to prevent drafts, there is always a competitor who will offer smaller equipment, less air and more optimism, and the buyer who considers price only is this man's fair prey. Exposure to air conditioning brings its own improvement in standards so we can expect a gradually awakening consciousness in the buyer who will be able to analyze a cheap bid for just what it is—inferior equipment and application.

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*Avery Engrg. Co.

The Customer Is Always Right?

But what of the employee, the office worker or the restaurant waitress? These people are not concerned with what the equipment cost, but how it appeals to them. The office workers may have been fighting dirt, wind and noise coming in the open windows or wildly fluctuating heating, and because they are used to it make very little complaint. Then the progressive employer installs air conditioning and the worker immediately expects perfection. The slightest air motion is called a "bad draft." A variation of 2 F is criticized as "uneven temperatures." A slight stale odor of recirculated air is "a terrible stink." No, he does not tell the boss these things as a rule but prefers to offer his opinions to his associates and friends, thus making him a qualified "expert" in their eyes on the subject of the wonderful new invention, air conditioning. Very few restaurant employees really like air conditioning. The contrast between the cooled dining room and overheated kitchen exaggerates the discomfort for those who dash back and forth. They would like the restaurant cold enough to actually store up cooling in themselves to carry through the time they go into the kitchen to get their food, and anything less than that is short of perfection. Obviously the customers would be killed off if the restaurant were cooled to this degree.

Of course the customer is always right; he's been told that and believes it. He may be the average normal person who really appreciates good air conditioning and makes a practice of patronizing only those restaurants, stores and theaters that have properly applied systems. Or he may be a crank, an eccentric, or a physically handicapped person who feels his purpose in life is to make the world adjust to him and revels in making others uncomfortable. He makes nasty remarks about his food in the restaurant and now enjoys taking a crack at the air conditioning. He crawls all over the store clerk trying to help him select his goods and complains that the air conditioning is terrible. He moves around from one seat to the other in the theater and finally leaves demanding his money back because the air was drafty, but he didn't like the show anyway.

Some of them can't help it. They are built that way. Some require colder air than a normal person. A few others cannot stand much cooling or any air motion. Fortunately, they are few—possibly 5 per cent of the public—and they are medical cases rather than air conditioning problems. But the normal person must be pleased and he is educated now—again through exposure—so that he will not tolerate a smelly, drafty room just because it has a little cooling and has a sign outside "Air Conditioned for Your Health and Comfort."

The development along practical lines of the universal use of air conditioning is in the hands of the designing engineer. He makes and adheres to his own standards, which must be well above the minimum. He makes the compromises with perfection and the ideal without falling too far below his standards. He knows he is dealing with definite, tangible things that produce indefinite, intangible effects on people, and all people are not alike. And above all, he knows that his engineering is in error unless it is reasonable. The physician assists nature in its effort to make the sick person well. The air conditioning engineer assists nature in providing a comfortable and healthful air environment. This is a very reasonable endeavor and wider acceptance is dependent largely on "reasonable engineering."

Eastern Conference—

[*Concluded from p. 743*]

customers less irritable and easier to serve, customers stay longer and buy more, and increased profits. In the industrial field, the following reasons for buying air conditioning are emphasized: Improved quality of product, low manufacturing cost, protection of inventories, improved employee health and efficiency, and workers are more satisfied and hence there is a lower labor turnover.

J. C. Albright[8] presented a paper on climatic data in air conditioning design which included a great deal of information on this subject which has recently been made available on the interrelation of dry bulb, wet bulb and dew point temperatures, wind velocity, and sunshine. His paper is not abstracted any further here because this analysis was presented at the annual meeting of the American Society of Heating and Ventilating Engineers last January, and was published in the ASHVE *Journal Section,* HEATING, PIPING AND AIR CONDITIONING, March, 1939, pp. 175-190.

Carl F. Boester[9] discussed refrigeration storage for handling peak loads, in a paper similar to that presented at the Atlanta meeting of the ASHVE in October and published in the ASHVE *Journal Section,* HEATING, PIPING AND AIR CONDITIONING, November, 1939, pp. 710-712. He said that a ton of refrigeration can be accumulated in approximately 37 cu ft of space. A typical evaporator is constructed of 5/8 in. copper tubing on 3½ in. centers, and using approximately 500 lineal feet of tubing, might have dimensions of 14 in. in width, 16 in. in height and 84 in. in length, with the ice accumulated upon it. This amount of ice, plus the chilled water surrounding it in the tank, has the equivalent of 288,000 Btu of refrigerating effect. A well designed storage system will accumulate a ton of ice at a power consumption of some 22 kwhr. This is because the compressor runs at a constant load most of the time and at night when advantage can be taken of lower wet bulb temperatures which contribute to lower condensing temperatures if cooling towers or evaporative condensers are used.

It is relatively simple to accumulate ice, he said, but it is quite difficult to melt the ice at the peak rate or at any desired percentage of that rate as required. The success of the application of storage refrigeration hinges upon the ability to control this melting rate, he stated.

Charles Brooks[10] discussed modified atmospheres for fruits and vegetables in storage and in transit.

Prof. Philip Drinker, of the Harvard University school of public health, spoke at a dinner meeting of the conference on "the air we breathe."

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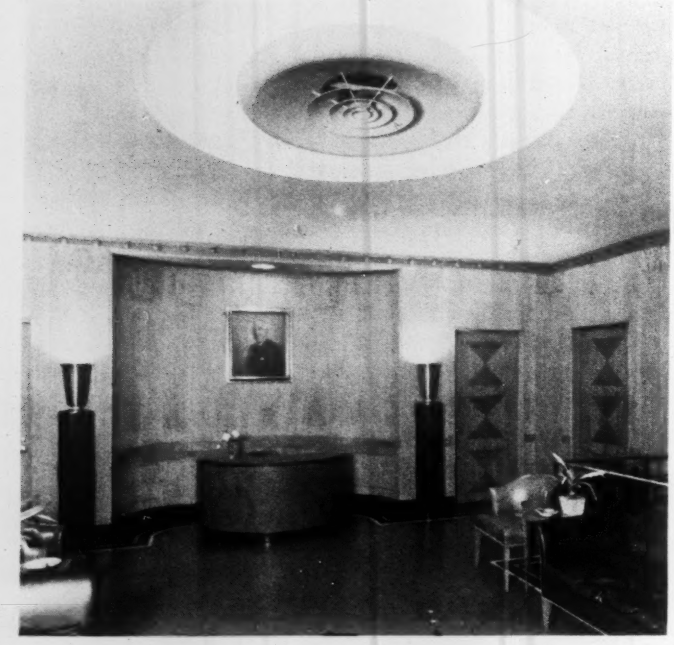
[8] The Marley Co.

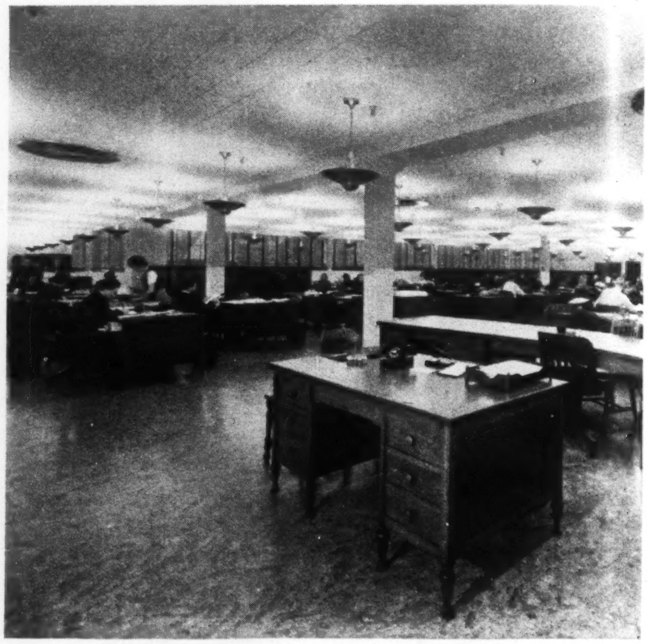
[9] Air Conditioning Engineer.

[10] U. S. Department of Agriculture.

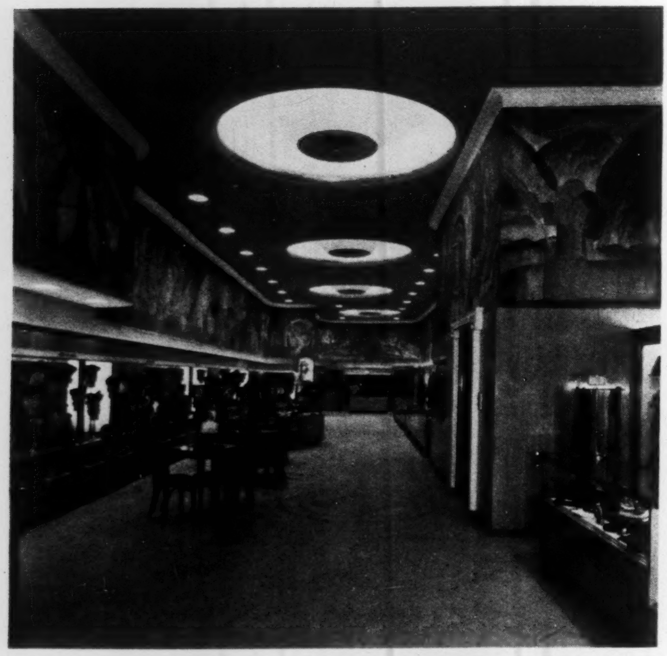
Modern Lighting and Air Conditioning



Reception room of the air conditioned Pepsodent Co. offices in the Clearing industrial district of Chicago. The edge of the air diffuser fixture is turned up in this case and the lights are concealed behind this edge, as contrasted with the Three Sisters job, where the lights are around the circumference of the coffer



A view in a general office area at the Pepsodent Co., showing air diffusing outlets of standard design and indirect lighting fixtures. This air conditioning installation is a well water job having about 80 tons of refrigerating effect. There are separate zones for each exposure, each large private office, and each group of smaller offices. Air Comfort Corp. designed the system



The new Three Sisters store on Chicago's State St. The ceiling is a dark bronze with aluminum finished high velocity air diffusers in the centers of the circular lighting coffers. The incandescent lighting bulbs are around the edge of each coffer concealed by a lip. The scheme gives effectiveness to displays, and also features the air outlets to stress to patrons that the store is air conditioned. Lighting intensity is 8 watts per sq ft on the first and second floors. Air Comfort Corp. designed the system

The Bank of Madison installation, Madison, Wis., involved converting a store into a banking room, and due to the conditions a scheme of ventilating by which the air supply could be introduced from the ceiling was adopted. Because of the long narrow ceiling plan, the locations of the lighting fixtures also proved to be desirable locations for the air distribution outlets, according to Law, Law and Potter, the architects. By combining air distribution and lighting fixtures, an effective solution was possible

Charts Simplify Pipe Size Selection for Industrial Water Piping Systems

By E. A. Windham[*]

THE purpose of this discussion is to outline some of the problems involved in designing industrial water piping systems. It is hoped that these charts and methods, which we have used during the past four years, will be of assistance to others also.

The total losses in a water piping system may be designated by the equation:

$$\Delta P_T = H_1 + H_2 + H_3 + H_4 + H_5 + H_6 + H_7$$

where ΔP_T = total pressure loss in system;

H_1 = pressure loss due to friction (This is shown on the chart of Fig. 1, which gives the pressure loss in feet of water per 100 ft of pipe for various quantities of water and various standard IPS pipes. The chart is based upon commercially clean pipes and 70 F water);

H_2 = pressure loss due to hand valves and fittings (Fig. 2 gives the losses for various fittings in terms of velocity head, $h = v^2/2g$ where h = loss in feet of water and v = velocity in feet per second);

H_3 = static head or pressure necessary to lift the water from source to the equipment;

H_4 = pressure losses due to equipment used, such as interchangers, cooling coils, spray nozzles, etc.;

H_5 = pressure losses due to modulating control valves;

H_6 = pressure losses due to entrance (This is generally neglected, but should be considered if the total system loss is small);

H_7 = pressure losses due to sudden enlargement or contraction of piping (Usually this also is neglected, the same as H_6).

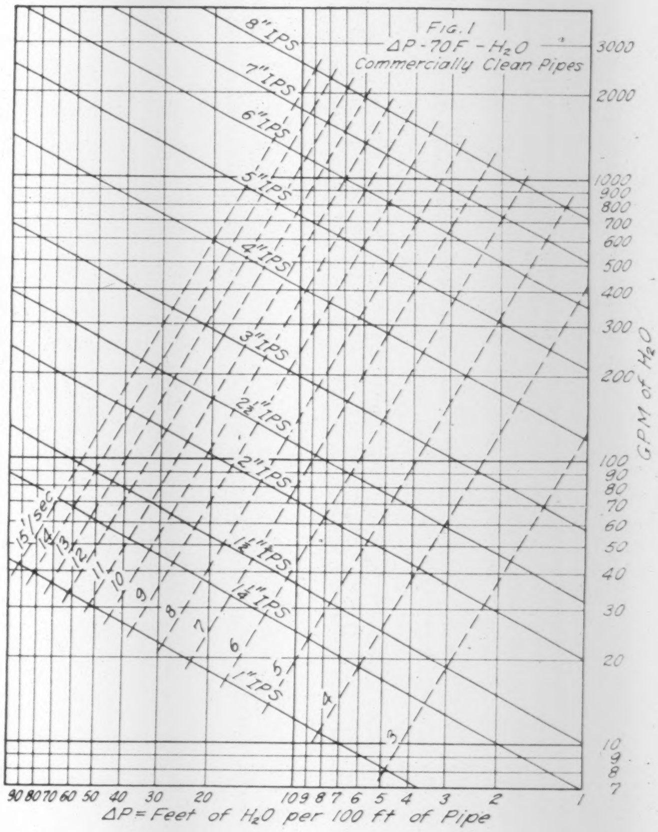
Variation in water temperature affects the friction loss H_1 only slightly. Water at 40 F will have friction loss approximately 10 per cent in excess of that shown in Fig. 1. Water at 200 F will have friction loss approximately 10 per cent less than that shown.

The increased friction loss due to corrosion may be very great. This depends upon the characteristics of the water in each locality. The water temperature usually materially affects the scaling (the higher the temperature the greater the scaling). In general, the friction loss H_1 should be increased by 10 to 20 per cent to allow for corrosion, although the years of expected service, character of local water, and the temperature of the water should be thoroughly studied in arriving at the allowance to be used. This is especially true when the loss H_1 is an extremely large percentage of the total loss, ΔP_T.

Types of Water Piping Systems

There are essentially three types of systems common in industrial plants:

1) Open systems--when city water is used and then thrown away.



2) Closed systems—where the water is recirculated through a circuit and continuously used.

3) Open pumping systems—where the water is pumped from a nearby river and returned to it after use.

Open System—This is a simple system to design. The problem consists of determining the available pressure and losses through equipment and then sizing the pipe as small as possible with the limit of the allowable losses.

Example—A water main has a pressure equal to 115 ft of water. It is desired to utilize a maximum of 150 gpm of water for an interchanger. The interchanger is 20 ft above the supply main and requires a total of 250 ft of pipe and six 90 deg elbows from the main to the interchanger and from there to the drain. The pressure loss through the interchanger is 15 ft of water

The charts and methods outlined here have been used by the author during the past four years for choosing pipe sizes for industrial and other water piping systems. Of particular interest is the chart given for selecting the approximate economical diameter for such piping . . . . . . The pressure drop chart was developed from the curve given by Mr. Windham in the January HEATING, PIPING AND AIR CONDITIONING

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[*] Engineering Dept., Surface Combustion Corp.

and the modulating valve has a loss of 20 ft of water when handling 150 gpm.

Available head ....115 ft

H_3, Static head ....20 ft

H_4, Interchanger ....15 ft

H_5, Modulating valve ....20 ft

Sum of H_3, H_4, and $H_5 = 55$ ft. Therefore, the head available for H_1 and $H_2 = 115 - 55$ or 60 ft.

Referring to Fig. 1 it will be seen that when handling 150 gpm of water the friction loss will be: 6 ft per 100 ft for a 3 in. IPS pipe, 17 ft per 100 ft for a 2½ in. IPS pipe, or 40 ft per 100 ft for a 2 in. IPS pipe.

Obviously, it would be advisable to try the 2½ in. pipe.

$H_1 = 2.5 \times 17 = 42.5$ ft.

Velocity = 10 fps (Fig. 1).

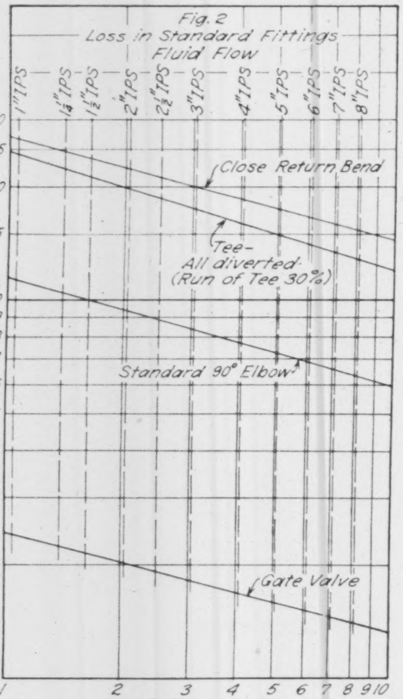
$H_2 = 0.88$ velocity head per elbow.

$(10^2 \div 64.4) \times 0.88 \times 6 = 8.2$.

Estimated total of $H_1 + H_2 = 42.5 + 8.2 = 50.7$.

Allowance, 10 per cent = 5.1.

Total = 50.7 + 5.1 = 55.8 ft. This gives a safety factor of approximately 4.2 ft and is undoubtedly the most economical pipe to use.



Closed System—The simplest type of closed system is where only one piece of equipment, such as a cooler, is used. The problem then is properly to select the pump for the right quantity and head of water and to select the most economical piping system. An accurate design of the most economical piping system is extremely complicated. Since standard pipe may be obtained only in certain sizes it is of doubtful value to carry the calculations to an extreme. What is mainly desired is the approximate design basis to use with a given set of conditions.

A suggested method to determine the approximate design basis for a specific problem is the use of the following formula:

$$h = \sqrt[1.285]{\frac{540\,CI}{G^{0.48}\,KN}}$$

where h = the most economical design head in feet of water per 100 ft of pipe;

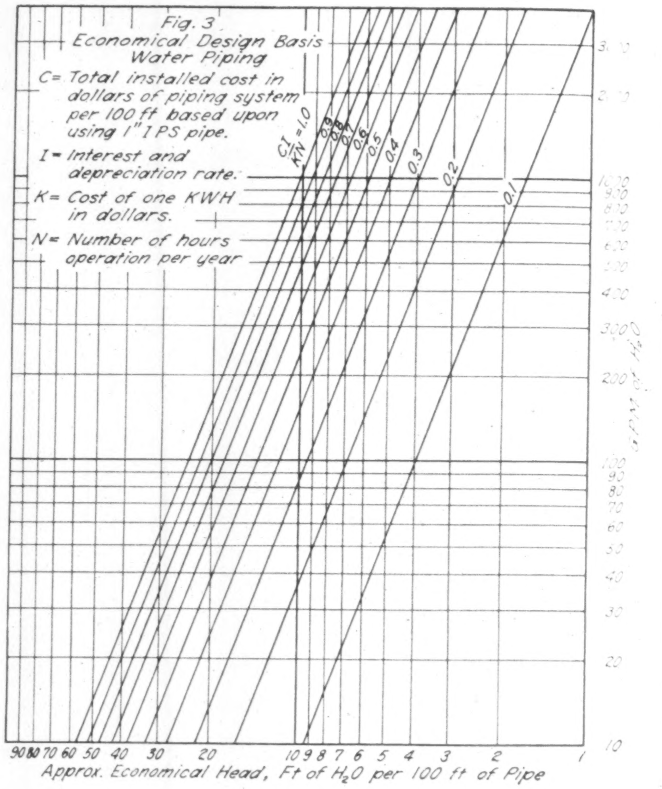
C = the cost of the piping system per 100 ft based upon using 1 in. IPS pipe throughout;

I = annual interest and depreciation rate;

G = gpm of water to be circulated;

K = cost of 1 kwhr in dollars;

N = number of operating hours per year.



The chart of Fig. 3 gives a graphical solution to the above formula which greatly simplifies the solution.

Example—Assuming that the previous example was a closed system and assume the cost of the system when using 1 in. IPS pipe is estimated to be $100.

$C = 100/2.5 =$ \$40 per 100 ft of 1 in. pipe (Total 250 ft of piping); $I = 20$ per cent $= 0.2$; $K = 1c =$ \$0.01; $N = 8000$ hr; $G = 150$ gpm.

$$\frac{CI}{KN} = \frac{40 \times 0.2}{0.01 \times 8000} = \frac{8}{80} = 0.1$$

From Fig. 3, $h = 3.4$ ft of water per 100 ft of pipe.

Referring to Fig. 1, we see that a 3 in. IPS pipe gives an h of 6 ft while a 4 in. IPS pipe gives an h of 1.54 ft of water per 100 ft of pipe. Since first cost is usually an important consideration it would be advisable to use the 3 in. IPS pipe in this case.

In this example, if N had been 1000 hr the value CI/KN would be 0.8 and the value of the most economical h would be 17 ft of water per 100 ft of pipe. Referring to Fig. 1, it would indicate that a 2½ in. IPS pipe would be used.

In cases where the closed system has a number of pieces of equipment in parallel, the following are recommended:

1) Select the system having the greatest amount of piping which also requires a reasonable percentage of the total water being used and estimate the cost of the piping based upon a 1 in. IPS pipe. Determine the value C from this.

2) Determine the most economical design head h from Fig. 3. Use G in this case to be that required for the single system selected.

3) Using Fig. 1 design the main supply and return system based upon this value of h but using the total gpm of water that will flow in each section of pipe

4) Size the intermediate piping to the other equipment on the basis as outlined for "open system."

Open Pumping System—Where it is desired to pump water from an adjoining river and return to the stream after using, the procedure recommended for "closed system" may be used to advantage.

The Psychrometric Chart

Its Application and Theory

By William Goodman*

THERE is probably no field of air conditioning that has been so misunderstood and about which more incorrect statements have been made than that dealing with temperatures below freezing. If air conditioning processes are analyzed by means of a chart like Chart C, many facts will become self-evident and many errors in basic conceptions avoided.

Conditions Below Freezing Temperature

The field of Chart C to the right of the saturation curve still represents mixtures of air and superheated vapor only. But, when measuring wet bulb temperatures below 32 deg, the water on the wick of the thermometer may be either frozen or subcooled. Although water usually freezes at 32 deg, water nevertheless can be cooled to roughly about 10 deg without freezing. Water subcooled below the freezing point is in an unstable condition and a slight shock or even a minute particle of ice brought into contact with the water will cause it to solidify immediately. Subcooling of water occurs occasionally on the wick of a wet bulb thermometer. The water on the wick will subcool instead of freezing and the thermometer will indicate a temperature below 32 deg. Suddenly the mercury will rise to 32 deg as the water on the wick freezes. After the ice has frozen, the mercury will again drop as the ice is cooled by evaporation from its surface.

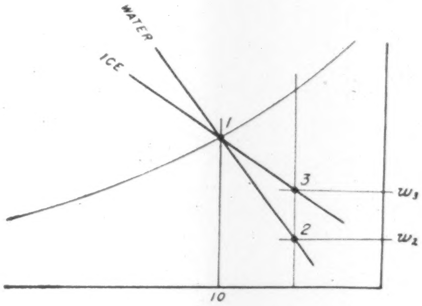


Fig. 20—For the same wet bulb temperature, the slope of lines of constant wet bulb temperature will differ if wick of thermometer is covered with ice or with water. Angle between the wet bulb lines is exaggerated for the sake of clarity

When finding the absolute humidity of the air on a psychrometric chart, the slope of the wet bulb lines depends on whether or not ice forms on the wick of the thermometer. The slope of the line is determined by the enthalpy of either the ice or subcooled water on the wick. Consequently, for temperatures between 32 deg and about 10 deg, there are two wet bulb temperature lines; one for wicks with subcooled water and one for wicks with ice. For this reason, in order to draw these wet bulb lines on the chart it is important to know whether the wet bulb temperatures were read with ice or with subcooled water on the wick of the thermometer.

Below 32 deg, the slope of the wet bulb lines is determined by the enthalpy of the subcooled liquid or the ice on the wick. The enthalpy of subcooled water is figured by $h = t — 32$†, and it is, of course, a negative quantity. For example, if the temperature indicated by a thermometer with a wick containing subcooled water is 10 deg above zero, the enthalpy of the water will be —22 Btu (10 — 32). On the other hand, if the wick is frozen and the thermometer reads 10 deg above zero, the enthalpy of the ice is —153.8 Btu as obtained from the table on page 2 of the January, 1938, HEATING, PIPING AND AIR CONDITIONING. Drawing the lines corresponding to these two moisture ratios through point *1* of Fig. 20, the lines *1-2* and *1-3* are obtained. Both of these lines are drawn for the same wet bulb temperature as read on the dry bulb temperature line through point *1*. From Fig. 20 it is apparent that for the same dry bulb temperature through points *2* and *3*, the same wet bulb temperature can be indicated by a thermometer covered with water and a thermometer covered with ice only if there is a difference in the absolute humidities of the air surrounding the two thermometers.

In the same room two wet bulb thermometers measuring the same absolute humidity will, of course, indicate different wet bulb readings if one wick is covered with ice and the other with subcooled water. In Fig. 21, point *1* represents the condition of the air in the room. The wet bulb temperature that would be indicated by a thermometer covered with subcooled water is shown by point *2* whereas the wet bulb temperature that would be indicated by a thermometer covered with ice is shown by point *3*.

In Fig. 21, if the air in contact with the water be-

Probably no field of air conditioning has been so misunderstood as that dealing with temperatures below freezing. A psychrometric chart for the low temperature range is given here, and if air conditioning processes are analyzed by means of it, many facts will become self-evident and errors in basic conceptions avoided. . . . In the series of which this article is a part, new psychrometric charts covering the low, middle and high temperature ranges, with saturation curves for various barometric pressures, are presented. The theory of the psychrometric chart is discussed, and methods of solving air conditioning problems are explained in detail

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*The Trane Co. Member of Board of Consulting and Contributing Editors.

Part 7. Part 1 was published in HEATING, PIPING AND AIR CONDITIONING, June, 1939, pp. 357-360; Part 2 in July, pp. 421-424; Part 3 in August, pp. 485-487; Part 4 in September, pp. 549-551; Part 5 in October, pp. 613-615 and p. 617; and Part 6 in November, pp. 671-674.

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†See table of symbols, p. 358, June issue.

comes saturated, its dry bulb temperature will be lowered to point *2*. On the other hand, if the air is in contact with ice and becomes saturated, its dry bulb temperature will be lowered to point *3*. The reason that the air in contact with ice is cooled to a lower dry bulb temperature—even though less moisture is vaporized—is due to the fact that the air must surrender sufficient heat both to melt the ice and to vaporize the liquid. In other words, when in contact with ice the air must surrender a quantity of heat that is equal to the heat of sublimation of the ice, whereas in contact with water the air must surrender a quantity of heat that is equal only to the heat of vaporization.

For temperatures below 32 deg, the water must be

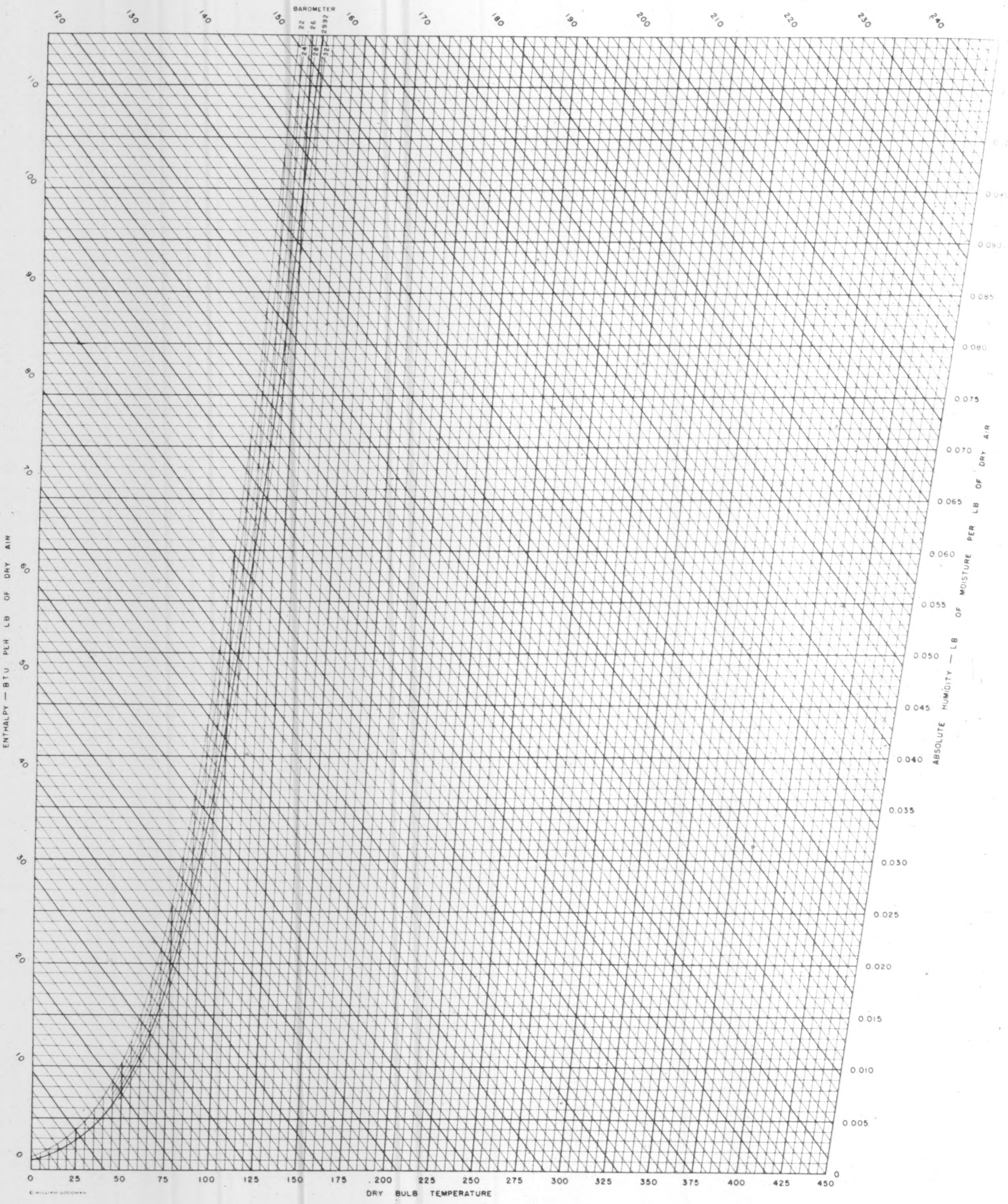


Chart B—Psychrometric chart for high range of temperatures from 0 to 450 deg

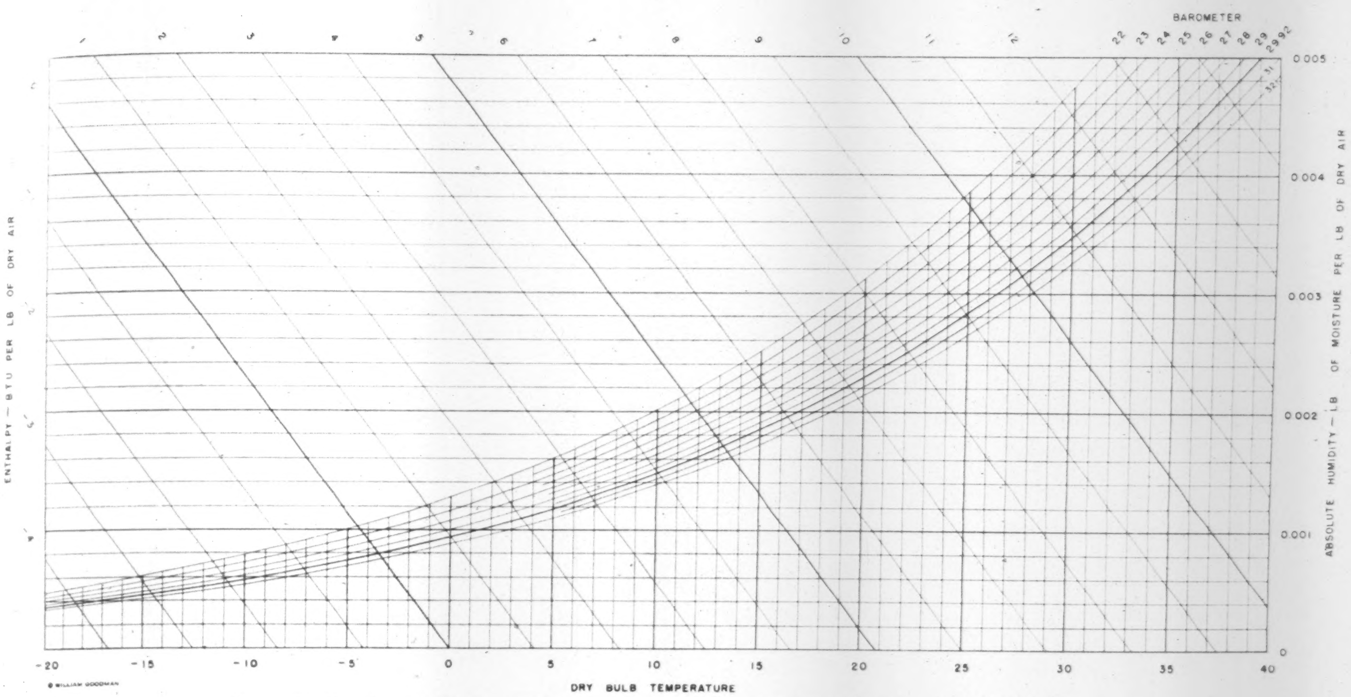


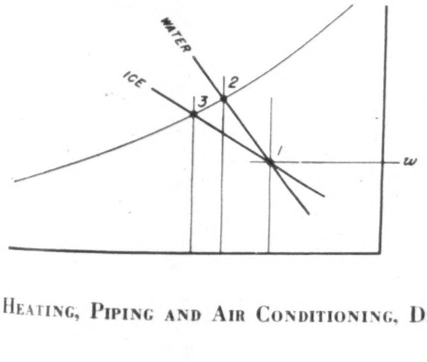
Chart C—Psychrometric chart for low range of temperatures from —20 to +40 deg

completely liquid or completely frozen. Mixtures of ice and subcooled water cannot exist. However, at exactly 32 deg it is quite possible to have mixtures of ice and water because water can exist in both the liquid and solid states at this temperature. In Fig. 22, if the wick is covered solely with water at 32 deg, the wet bulb line will be represented by a line such as *1-5*. If the wick is covered solely with ice at 32 deg, the wet bulb line will be represented by *1-4*. However, if the wick is covered with a mixture of ice and water, then the wet bulb line for this condition will lie somewhere between *1-5* and *1-4*. The exact slope or location of this line will of course depend upon the enthalpy of the mixture of ice and water, and this in turn depends upon the proportions of ice and water present in the mixture. As a result, the exact line representing the wet bulb temperature of 32 deg cannot be located with any degree of precision because there is no way of finding the proportions of ice and water present in the wick. Hence, for a wet bulb of 32 deg, and for any given dry bulb temperature above 32 deg—such as the line of dry bulb temperature through points *4* and *5*—the point representing the state of the air must lie somewhere between *4* and *5*. The exact point depends, as previously stated, upon the proportions of ice and water in the mixture on the wick of the wet bulb thermometer. For this condition the absolute humidity of the air lies somewhere between points *4* and *5*. If the wick is covered with either water or ice alone, then there is, of course, no uncertainty as to the absolute humidity of the air.

The end points given in Tables 2 to 13 can be used to locate the wet bulb lines for temperatures below 32 deg. For all wet bulb temperatures below 32 deg, two values are given for the end point of each wet bulb temperature along the line of zero absolute humidity. One value is in the column marked "Over Ice" and is to be used when the wick is covered with ice. The second column is marked "Over Water" and is to be used when the wick is covered with subcooled water.

So far, this discussion has covered only unsaturated air—that is, air whose condition is represented by a point to the right of the saturation curve. As is the case for wet bulb temperatures above 32 deg, the state of the air may also be represented by a point to the left of the saturation curve for temperatures below 32 deg. In this case, however, the free moisture will be frozen. Consequently, points to the left of the saturation curve represent mixtures of air, saturated vapor, and snow.

Fig. 21—For the same absolute humidity in a conditioned space, a wet bulb thermometer covered with water will indicate a different temperature than one covered with ice. Angle between lines exaggerated for sake of clarity



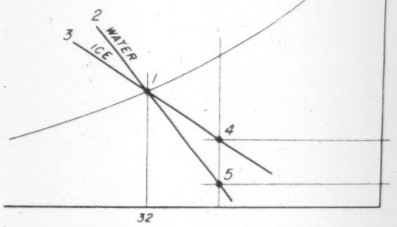
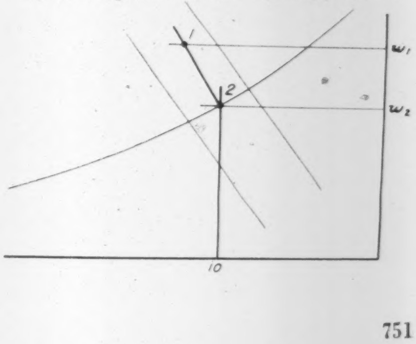


Fig. 22—When the wet bulb thermometer indicates exactly 32 deg, there may be uncertainty as to the exact absolute humidity of the air. In this case, the absolute humidity of the air may be represented by any point between points 4 and 5. Angle between lines exaggerated for clarity

Fig. 23—Below 32 deg any state point in the fogged field of the chart represents a mixture of air, saturated vapor, and snow. The slope of line 1-2 corresponds to the enthalpy of ice



In Fig. 23, point *1* represents the condition of a mixture of air, saturated vapor, and snow. The temperature of the mixture is read along the wet bulb line *1-2*. The slope of the line *1-2* corresponds to the enthalpy of ice, inasmuch as the air is mixed with ice or snow. The weight of snow in the mixture is the difference between the absolute humidities at points *1* and *2*, and the weight of saturated vapor in the mixture is the absolute humidity at point *2*.

For air at exactly 32 deg in the fogged field, the problem is exactly similar to the case previously described where the state of the air is represented by a point in the field for unsaturated air. If the air is mixed with fine drops of liquid at 32 deg, the state of the air would be read in Fig. 22 along the line *1-2*, the slope of which corresponds to the enthalpy of liquid at 32 deg. On the other hand, if the air is mixed with snow alone, the state of the air would be represented by a point lying along the line *1-3*, the slope of which corresponds to the enthalpy of ice at 32 deg. However, if both snow and free liquid are held in suspension in the air, then the condition of the air would be represented by a point on a line which is located between lines *1-2* and *1-3*. The slope, and hence the exact location of the line in this case, would depend upon the enthalpy of the mixture of snow and liquid. In turn, the enthalpy of this mixture depends upon the proportions of liquid and snow present in the 32 deg mixture.

Theoretically, because the vapor pressures over ice and subcooled water are different, the absolute humidity of air at the same temperature should be different when in contact with ice and when in contact with subcooled water. Therefore, different saturation curves should theoretically be shown on Chart C for air in contact with ice and for air in contact with subcooled water. Actually, from experimental results, the absolute humidity of air in contact with ice has been found to agree with computations based on the vapor pressures of subcooled water. Accordingly, the saturation curve for subcooled water is shown in Chart C and used for air in contact with either ice or subcooled water. This was discussed in further detail in the article New Tables of the Psychrometric Properties of Air-Vapor Mixtures in the January and February, 1938, issues of HEATING, PIPING AND AIR CONDITIONING.

[*To be continued*]

Steam Consumption for Humidifying

A reader of HPAC has called attention to the steam consumption figure of 0.72 lb of steam per degree day per 1000 cu ft of building volume given for the air conditioned building described by Charles N. Bailey* in the October issue, and the average figure for 153 buildings reported in the study of building heating economies by Earle Shultz and J. C. Butler in that same issue. He felt that with all the care taken in scheduling heating and air conditioning operation for the first-mentioned building, that the steam consumption should compare more favorably with the 0.605 lb average.

The increased steam consumption of the air conditioned building over that reported for the average of 153 buildings is due to the air conditioning and to other factors, Mr. Bailey explains. The average non-mechanically ventilated building has only one or two air changes per hour whereas the Chicago code calls for six air changes per hour for ventilated buildings with an increase to 10 changes per hour for restaurant space. Another reason for the increased steam consumption is the fact that 25 per cent of the stores in the building referred to are open until 10:00 p. m. and the large restaurant to 1:00 a. m., whereas most office buildings shut down their heating plants at about 6:00 p. m.

Part of the increase is also due to humidifying. Contrary to popular belief, humidifying does not decrease the heat bill even though it does decrease the indoor temperature. Consider, for example, 40 F outside air at 100 per cent relative humidity raised to 70 F and 50 per cent relative humidity as compared to raising its temperature to 75 F without changing its total moisture content. The total heat of 40 F air at 100 per cent relative humidity is 15.2 Btu per lb. The total heat of 70 F air at 50 per cent relative humidity is 25.2 Btu. The sensible heat necessary to raise 40 F air to 75 F is 8.4 Btu, which when added to the total heat of the 40 F saturated air gives a total heat for the 75 F air of 23.6 Btu or 1.6 Btu less than for the 70 F, 50 per cent relative humidity air.

Seventy-five degrees is a value often taken arbitrarily as the temperature of the dryer air that will give the same comfort to the average office employee as the 70 F air that has been humidified to 50 per cent (even though it is not true on the comfort chart of the ASHVE). All of these figures are very much in the favor of the dryer air and yet they show that humidifying requires steam consumption.

Another cause of increased heat consumption in the building under discussion is the tremendous amount of single plate glass in the building. Three-fourths of the wall area of the second floor is glass.

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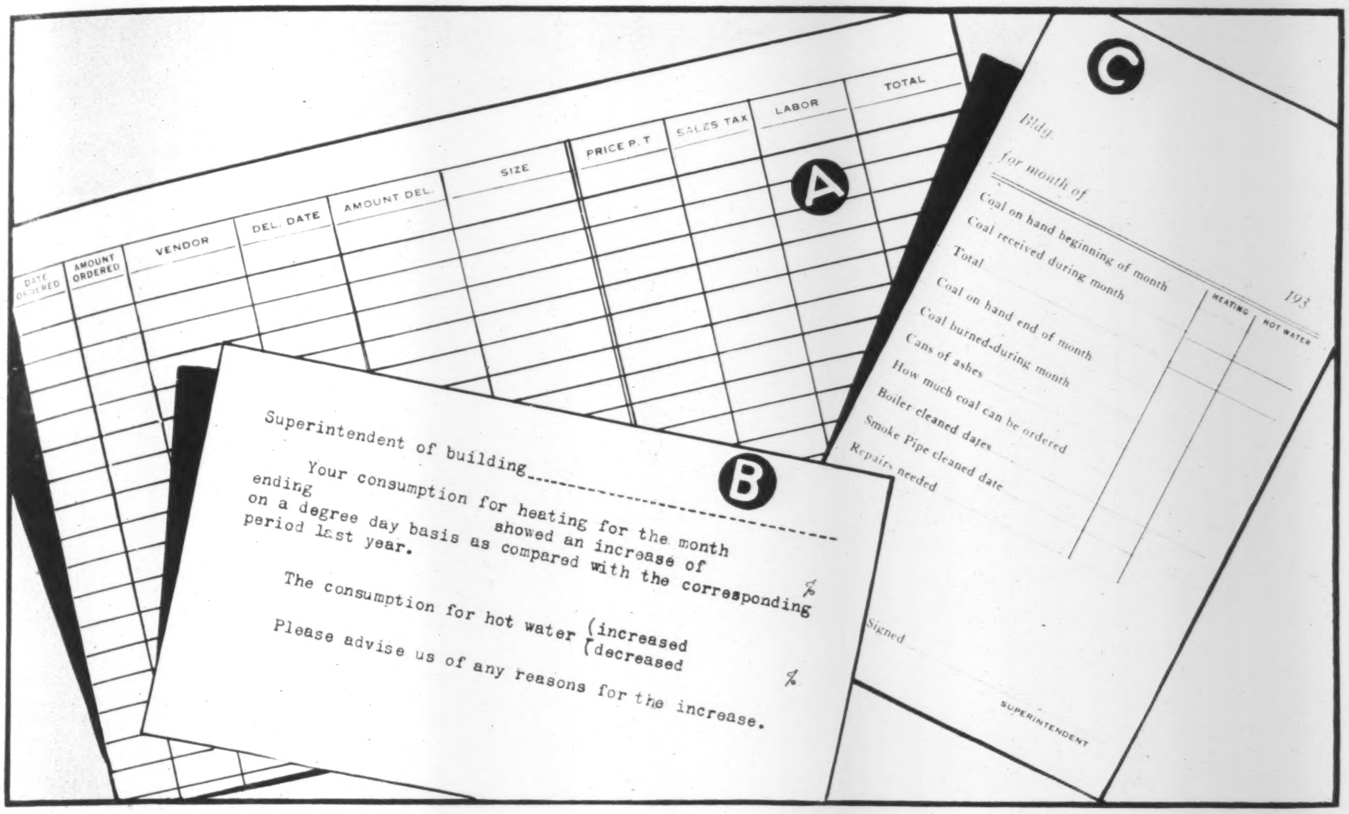
*Assistant to the General Superintendent, Aldis & Co., Building Management.

Physicians Report Benefits of Air Conditioning

Seventy-two per cent of the doctors now using air conditioning in their offices have recommended it to other physicians, 48 per cent have recommended it to their patients, and 47 per cent have recommended it to their personal friends. Nine out of 10 doctors find that the comfortable environment of an air conditioned office helps to make their patients more relaxed and coöperative, thus rendering diagnosis and treatment easier. These findings—and others—have been disclosed by the magazine *Medical Economics*, following a nation-wide survey of the experiences of doctors who have installed air conditioning in their offices, according to the Air Conditioning Manufacturers' Association.

Of particular interest as an index of the medical profession's attitude toward the reputed health values of air conditioning were replies to the question about the benefits of conditioned air to patients suffering from various ailments. Seventy-two per cent believe that hay fever sufferers will enjoy relief in air conditioning. 63 per cent think it has therapeutic values for asthma.

[*Concluded on p. 754*]



DATE ORDERED	AMOUNT ORDERED	VENDOR	DEL. DATE	AMOUNT DEL.	SIZE	PRICE P. T	SALES TAX	LABOR	TOTAL

Superintendent of building______________________________

Your consumption for heating for the month ending ____________ showed an increase of ____ % on a degree day basis as compared with the corresponding period last year.

The consumption for hot water (increased (decreased ____ %

Please advise us of any reasons for the increase.

Bldg.

For month of ____________ 193

	HEATING	HOT WATER
Coal on hand beginning of month		
Coal received during month		
Total		
Coal on hand end of month		
Coal burned during month		
Cans of ashes		
How much coal can be ordered		
Boiler cleaned dates		
Smoke Pipe cleaned date		
Repairs needed		

Signed ____________________
SUPERINTENDENT

These record forms aid the building management company in promoting heating economies. Form *a* gives a record of fuel orders and deliveries, *b* is a postcard form sent to the building superintendent showing increases in fuel or steam for heating each month, and *c* is a monthly coal report sent to the management office by the building superintendent the first day of each month

Fuel Consumption Record Forms Help to Promote Heating Economy

By Lewis W. Mauger*

It is impossible to supervise intelligently the operation of a number of heating plants without an adequate set of records to show operating results. A permanent file for each property should be maintained showing the size and type of the building, the cubic content, the square feet of radiation, the hours of service and containing a description of the plant with the size and type of boilers, the method of firing, the names of the manufacturers of equipment and the method of heating hot water. Any special service conditions, such as indirect radiation, restaurant requirements, process steam, all-night service, special temperatures, etc., should be noted. Any change, improvement, repair or addition to the building or heating system should be added to this file as such work is performed.

A second set of records should show fuel orders and deliveries with the dates ordered and delivered, the exact quantities received, and the cost. A card for each property—such as that reproduced here—serves well for this purpose. A monthly report should be obtained from the operator of each building as suggested by the form shown, reporting the quantity of fuel on hand at the beginning and end of each month, the amount of reserve and the net amount burned. It is also advisable to keep a record of the number of pounds, wheelbarrows or shovels of coal or the amount of oil consumed if meters are provided for this purpose. Over a period of time the inventory method is probably more accurate than the daily boiler room log, although the latter method is valuable for comparing consumptions from day to day.

The monthly reports should be tabulated, the degree days for the period noted and the consumption per degree day calculated. Although there are very few plants in which the consumption per degree day will remain constant each month of the heating season, this factor seems to be commonly used and provides a simple method of comparison. Any radical change in the use per degree day may be checked immediately and an unnecessary increase may be reduced within a reasonable period. For larger buildings, it is desirable to establish a standard of use per degree day, adding the fuel consumption for hot water or live steam purposes to the base estimate. The monthly analyses will show

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*Supervising Engineer, Brown, Wheelock, Harris, Stevens, Inc., Real Estate.

Adequate records are needed for the intelligent supervision of one or a number of building heating plants. Mr. Mauger describes the record forms used by a large management company and the manner in which such data help to promote efficiency in building heating

immediately whether the operation is exceeding or coinciding with the budget and will enable the supervisor to improve the operation if necessary.

An annual heating report showing such items for each building as the size and type of fuel, quantities, building cube, pounds per cubic foot, pounds per degree day and the pounds per thousand cubic feet per degree day is invaluable for comparative purposes. The consumption per 1000 cu ft per degree day may be compared each year with the previous results in the same building to show whether the operation is improving or retrogressing. The same factor may be used to compare results in various buildings of a similar type, and if the consumption is higher than normal, the building should be made a special object of study to determine if the plant is adequate, of a proper design and properly maintained and whether changes in the fuel or method of firing, additions to the plant or improvements in the method of control should be recommended.

A sample of part of a report of this kind showing results in several buildings in New York City is given in Table 1. Comparative fuel use per cubic foot per degree day for four heating seasons is given, and it appears that a gradual reduction in consumption is usually realized. Cases which show alarming increases can be seen at a glance in such a tabulation and investigated.

Two boilers in a bank building converted to fuel oil, using high pressure mechanical type burners under forced draft. Two other boilers in the plant were not converted and can be used for burning coal in case of a fuel oil shortage or a change in the price relationship of oil and coal. In addition to the usual gages, this heating plant is equipped with oil meters, CO_2 and flue gas temperature recorders, a draft indicator, a smoke indicator, and a steam flow meter. The brick settings are insulated

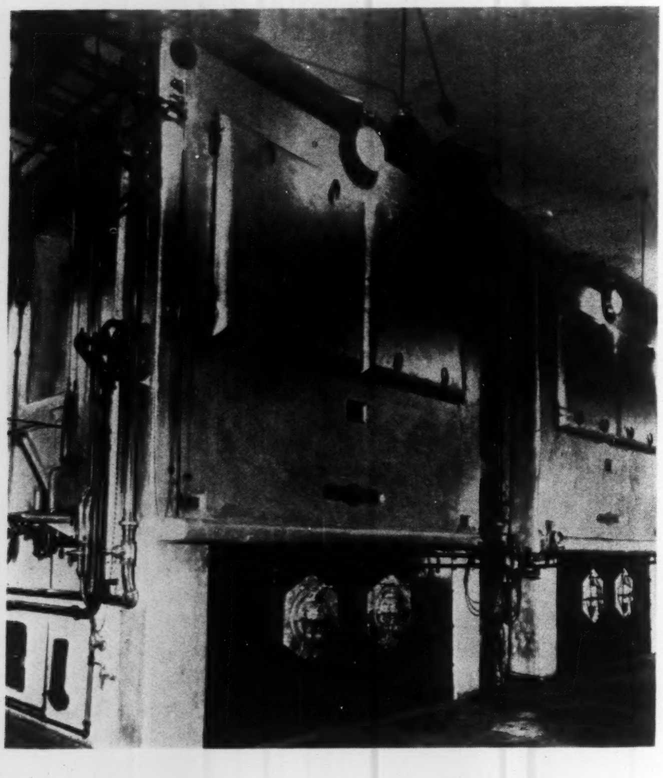

Table 1—Fuel Consumption Data for Several Buildings

Building	Fuel	Building Volume 1000 Cu Ft	Lb Fuel per M Cu Ft per Deg Day			
			1938-9	1937-8	1936-7	1935-6
Apartment	Buck	534	0.228	0.227	0.267	0.270
Loft	Soft	431	0.102	0.113	0.114	0.113
Loft	Buck	330	0.110	0.110	0.119	0.114
Apartment	Rice	1300	0.199	0.185	0.203	0.195
Loft	Buck	3250	0.077	0.070	0.078	0.071
Loft	Soft	1058	0.046	0.050	0.063	0.065
Loft	Buck	1094	0.131	0.139	0.138	0.139
Office	Soft	150	0.163	0.148	0.195	0.191
Office	Buck & Rice	791	0.093	0.088	0.094	0.095
Apartment	Buck	789	0.197	0.190	0.201	0.203

For New York City, which has a normal heating season of about 5300 degree days, the fuel factors shown in Table 2 may be considered satisfactory for heat and hot water per 1000 cu ft of heated space per degree day. Lower consumptions would be considered excellent and higher consumptions should be a signal for further study.

Table 2—Amount of Fuel per 1000 Cu Ft per Degree Day

	Purchased Steam	Hand Fired Anthracite	Stoker Fired Bituminous	Gallons of Fuel Oil
Small apartments	1.2 Lb	0.24 Lb	0.20 Lb	0.016
Large apartments	1.0 Lb	0.20 Lb	0.17 Lb	0.013
Office buildings	0.8 Lb	0.16 Lb	0.14 Lb	0.011
Loft buildings	0.6 Lb	0.12 Lb	0.10 Lb	0.008

Records of this kind are also used in preparing budgets and in determining the advisability of changing fuels. Since there is a variation in the cost of fuel oil, coal and purchased steam from year to year, the comparative costs can be readily calculated from such data.

Assembling quantities of information can occupy a considerable amount of time, so that an endeavor should be made to minimize the effort required both in preparing reports and in making permanent files. There is no justification in obtaining any form of information unless it is to be put to some useful purpose. With the data described above a management office is equipped with essential data but is not burdened with useless reports. The very fact that the plant operators know that their results are regularly checked and that reductions in consumption will be appreciated and increases will be called to their attention has a salutary effect upon the personnel. With this system in effect for a period of years, our records show a number of plants in which the annual consumption per degree day has shown a healthy decrease nearly every year.

[Concluded from p. 752]

31 per cent believe it helpful in sinus conditions, and 21 per cent for pneumonia. Favorable experiences were also mentioned with rheumatic, cardiac, heat exhaustion, and fever patients.

The poll revealed that 98 per cent of a doctor's patients comment on the added comfort of air conditioning, and that 29 per cent of the doctors can trace an increase in practice to the drawing power of an air conditioned office. Ninety-seven per cent of the doctors said they work more efficiently under air conditioning.

With air conditioning, 88 per cent of the doctors find their offices are easier to keep clean, 72 per cent notice a reduction in medicinal odors, and 90 per cent appreciate the exclusion of outside noise.

Properties of Mixtures of Air and Saturated Water Vapor for Barometric Pressures from 22 In. to 32 In. of Mercury

By William Goodman*

Barometric Pressure 27 In. of Mercury

All tabulated values (except temperatures and pressures) are quantities per pound of dry air in the mixture.

Temp Deg Fahr	Absolute Humidity		Volume		Humid Specific Heat	1061w	Enthalpy (Heat Content)	
	Pounds	Grains	Dry Air Cu Ft	Volume Increase of Humid Air Per Cent			Water Vapor Btu	Air-Vapor Mixture Btu
t	w	w	v_D		s''		h_V	h
1	2	3	4	5	6	7	8	9
-40	0.0001290	0.9027	11.72	0.02073	0.2401	0.1368	0.1345	-9.466
-39	.0001365	0.9556	11.75	.02195	.2401	.1449	.1425	-9.218
-38	.0001446	1.013	11.78	.02325	.2401	.1535	.1510	-8.969
-37	.0001531	1.072	11.81	.02462	.2401	.1625	.1599	-8.720
-36	.0001621	1.135	11.84	.02606	.2401	.1720	.1694	-8.471
-35	0.0001714	1.200	11.86	0.02755	0.2401	0.1818	0.1791	-8.221
-34	.0001814	1.270	11.89	.02916	.2401	.1924	.1897	-7.970
-33	.0001918	1.342	11.92	.03083	.2401	.2034	.2006	-7.719
-32	.0002028	1.420	11.95	.03260	.2401	.2151	.2122	-7.468
-31	.0002141	1.499	11.98	.03443	.2401	.2272	.2242	-7.216
-30	0.0002264	1.585	12.00	0.03640	0.2401	0.2402	0.2371	-6.963
-29	.0002391	1.674	12.03	.03844	.2401	.2537	.2506	-6.709
-28	.0002523	1.766	12.06	.04056	.2401	.2677	.2645	-6.456
-27	.0002664	1.865	12.09	.04283	.2401	.2827	.2795	-6.201
-26	.0002810	1.967	12.11	.04518	.2401	.2982	.2949	-5.945
-25	0.0002964	2.075	12.14	0.04766	0.2401	0.3145	0.3112	-5.689
-24	.0003127	2.189	12.17	.05027	.2401	.3318	.3284	-5.432
-23	.0003298	2.309	12.20	.05302	.2402	.3499	.3465	-5.174
-22	.0003475	2.433	12.23	.05587	.2402	.3687	.3653	-4.915
-21	.0003662	2.563	12.25	.05887	.2402	.3885	.3851	-4.655
-20	0.0003858	2.701	12.28	0.06203	0.2402	0.4094	0.4059	-4.394
-19	.0004065	2.845	12.31	.06535	.2402	.4313	.4278	-4.132
-18	.0004278	2.995	12.34	.06878	.2402	.4539	.4504	-3.870
-17	.0004503	3.152	12.37	.07239	.2402	.4777	.4743	-3.606
-16	.0004741	3.319	12.39	.07622	.2402	.5030	.4996	-3.340
-15	0.0004985	3.490	12.42	0.08015	0.2402	0.5289	0.5256	-3.074
-14	.0005244	3.671	12.45	.08430	.2402	.5564	.5531	-2.807
-13	.0005516	3.861	12.48	.08868	.2403	.5853	.5821	-2.538
-12	.0005798	4.059	12.51	.09321	.2403	.6152	.6120	-2.268
-11	.0006089	4.263	12.53	.09790	.2403	.6461	.6431	-1.997
-10	0.0006404	4.483	12.56	0.1030	0.2403	0.6795	0.6766	-1.723
-9	.0006724	4.707	12.59	.1081	.2403	.7134	.7107	-1.449
-8	.0007067	4.947	12.62	.1136	.2403	.7498	.7473	-1.173
-7	.0007415	5.190	12.65	.1192	.2403	.7867	.7844	-0.8956
-6	.0007782	5.447	12.67	.1251	.2404	.8256	.8235	-0.6165
-5	0.0008172	5.720	12.70	0.1314	0.2404	0.8670	0.8652	-0.3348
-4	.0008570	5.999	12.73	.1378	.2404	0.9093	0.9077	-0.0523
-3	.0008990	6.293	12.76	.1445	.2404	0.9539	0.9527	+0.2327
-2	.0009432	6.603	12.79	.1516	.2404	1.001	0.9999	0.5199
-1	.0009894	6.926	12.81	.1591	.2405	1.050	1.049	0.8093
0	0.001036	7.255	12.84	0.1666	0.2405	1.100	1.100	1.100
1	.001086	7.601	12.87	.1746	.2405	1.152	1.153	1.393
2	.001138	7.963	12.90	.1829	.2405	1.207	1.208	1.688
3	.001192	8.343	12.92	.1916	.2405	1.265	1.266	1.986
4	.001249	8.741	12.95	.2008	.2406	1.325	1.327	2.287
5	0.001307	9.150	12.98	0.2101	0.2406	1.387	1.390	2.590
6	.001368	9.575	13.01	.2199	.2406	1.451	1.455	2.895
7	.001432	10.02	13.04	.2301	.2406	1.519	1.523	3.203
8	.001498	10.49	13.06	.2408	.2407	1.589	1.595	3.515
9	.001568	10.97	13.09	.2520	.2407	1.663	1.670	3.830
10	0.001639	11.47	13.12	0.2635	0.2407	1.739	1.746	4.146
11	.001715	12.01	13.15	.2758	.2408	1.820	1.829	4.469
12	.001793	12.55	13.18	.2883	.2408	1.903	1.912	4.792
13	.001872	13.11	13.20	.3010	.2408	1.987	1.998	5.118
14	.001959	13.71	13.23	.3149	.2409	2.078	2.091	5.451
15	0.002047	14.33	13.26	0.3290	0.2409	2.171	2.185	5.785
16	.002137	14.96	13.29	.3436	.2410	2.268	2.283	6.123
17	.002232	15.62	13.32	.3588	.2410	2.368	2.385	6.465
18	.002330	16.31	13.34	.3747	.2411	2.473	2.491	6.811
19	.002433	17.03	13.37	.3912	.2411	2.582	2.603	7.163
20	0.002539	17.77	13.40	0.4082	0.2411	2.694	2.717	7.517
21	.002651	18.56	13.43	.4262	.2412	2.813	2.838	7.878
22	.002765	19.35	13.46	.4445	.2412	2.934	2.961	8.241
23	.002885	20.19	13.48	.4638	.2413	3.061	3.091	8.611
24	.003009	21.06	13.51	.4838	.2414	3.192	3.225	8.985
25	0.003136	21.95	13.54	0.5041	0.2414	3.327	3.362	9.362
26	.003271	22.90	13.57	.5259	.2415	3.471	3.509	9.749
27	.003409	23.86	13.60	.5480	.2415	3.617	3.658	10.14
28	.003552	24.86	13.62	.5711	.2416	3.769	3.813	10.53
29	.003701	25.91	13.65	.5951	.2417	3.927	3.976	10.94
30	0.003857	27.00	13.68	0.6201	0.2417	4.092	4.145	11.35
31	.004019	28.13	13.71	.6462	.2418	4.264	4.321	11.76
32	.004182	29.28	13.73	.6723	.2419	4.438	4.499	12.18
33	.004359	30.51	13.76	.7005	.2420	4.624	4.691	12.61
34	.004538	31.77	13.79	.7295	.2420	4.815	4.887	13.05
35	0.004724	33.07	13.82	0.7593	0.2421	5.012	5.088	13.49
36	.004919	34.43	13.85	.7906	.2422	5.219	5.300	13.94
37	.005120	35.84	13.87	.8226	.2423	5.432	5.519	14.40
38	.005327	37.29	13.90	.8562	.2424	5.652	5.745	14.87
39	.005542	38.79	13.93	.8905	.2425	5.880	5.979	15.34
40	0.005765	40.35	13.96	0.9267	0.2426	6.116	6.222	15.82
41	.005994	41.96	13.99	0.9634	.2427	6.360	6.472	16.31
42	.006233	43.63	14.01	1.002	.2428	6.613	6.733	16.81
43	.006479	45.35	14.04	1.041	.2429	6.874	7.001	17.32
44	.006734	47.14	14.07	1.082	.2430	7.145	7.279	17.84
45	0.007002	49.01	14.10	1.125	0.2432	7.429	7.572	18.37
46	.007276	50.93	14.13	1.169	.2433	7.720	7.872	18.91
47	.007558	52.91	14.15	1.214	.2434	8.019	8.181	19.46
48	.007853	54.97	14.18	1.262	.2435	8.332	8.503	20.02
49	.008156	57.09	14.21	1.311	.2437	8.654	8.835	20.60
50	0.008473	59.31	14.24	1.361	0.2438	8.990	9.182	21.18
51	.008801	61.61	14.27	1.414	.2440	9.338	9.541	21.78
52	.009132	63.93	14.29	1.468	.2441	9.689	9.904	22.38
53	.009486	66.40	14.32	1.524	.2443	10.07	10.29	23.01
54	.009842	68.89	14.35	1.581	.2444	10.44	10.68	23.64
55	0.01021	71.49	14.38	1.641	0.2446	10.84	11.09	24.29
56	.01060	74.20	14.41	1.703	.2448	11.25	11.52	24.96
57	.01099	76.96	14.43	1.766	.2450	11.67	11.95	25.63
58	.01141	79.86	14.46	1.833	.2451	12.10	12.40	26.32
59	.01183	82.80	14.49	1.900	.2453	12.55	12.86	27.02
60	0.01226	85.84	14.52	1.971	0.2455	13.01	13.34	27.74
61	.01272	89.02	14.54	2.044	.2457	13.49	13.84	28.48
62	.01319	92.34	14.57	2.118	.2459	14.00	14.37	29.25
63	.01368	95.73	14.60	2.196	.2462	14.51	14.90	30.02
64	.01417	99.17	14.63	2.276	.2464	15.03	15.44	30.80
65	0.01469	102.8	14.66	2.359	0.2466	15.59	16.02	31.62
66	.01522	106.5	14.68	2.444	.2469	16.14	16.60	32.44
67	.01577	110.4	14.71	2.533	.2471	16.73	17.21	33.29
68	.01634	114.4	14.74	2.624	.2474	17.33	17.83	34.15
69	.01692	118.5	14.77	2.717	.2476	17.95	18.48	35.04
70	0.01753	122.7	14.80	2.815	0.2479	18.60	19.15	35.95
71	.01815	127.1	14.82	2.915	.2482	19.26	19.83	36.87
72	.01880	131.6	14.85	3.019	.2485	19.95	20.55	37.83
73	.01946	136.3	14.88	3.126	.2488	20.65	21.29	38.81
74	.02015	141.1	14.91	3.236	.2491	21.38	22.05	39.81
75	0.02086	146.0	14.94	3.349	0.2494	22.13	22.83	40.83
76	.02159	151.1	14.96	3.466	.2497	22.90	23.64	41.88
77	.02235	156.5	14.99	3.589	.2501	23.72	24.48	42.96
78	.02313	161.9	15.02	3.713	.2504	24.54	25.34	44.06
79	.02393	167.5	15.05	3.842	.2508	25.39	26.23	45.19
80	0.02476	173.3	15.08	3.974	0.2511	26.27	27.15	46.35
81	.02562	179.3	15.10	4.113	.2515	27.18	28.10	47.54
82	.02650	185.5	15.13	4.253	.2519	28.11	29.08	48.76
83	.02741	191.9	15.16	4.400	.2523	29.08	30.10	50.02
84	.02834	198.4	15.19	4.549	.2528	30.07	31.13	51.29
85	0.02931	205.2	15.22	4.705	0.2532	31.10	32.20	52.60
86	.03031	212.2	15.24	4.865	.2536	32.16	33.32	53.96
87	.03134	219.4	15.27	5.030	.2541	33.25	34.47	55.35
88	.03240	226.8	15.30	5.200	.2546	34.37	35.64	56.76
89	.03350	234.5	15.33	5.377	.2551	35.55	36.87	58.23
90	0.03463	242.4	15.35	5.557	0.2556	36.74	38.13	59.73
91	.03580	250.6	15.38	5.745	.2561	37.99	39.43	61.27
92	.03699	258.9	15.41	5.936	.2567	39.25	40.76	62.84
93	.03824	267.7	15.44	6.135	.2572	40.57	42.14	64.46
94	.03952	276.6	15.47	6.340	.2578	41.93	43.58	66.14
95	0.04083	285.8	15.49	6.551	0.2584	43.32	45.04	67.84
96	.04219	295.3	15.52	6.768	.2590	44.76	46.55	69.59
97	.04358	305.1	15.55	6.992	.2596	46.24	48.11	71.39
98	.04504	315.3	15.58	7.225	.2603	47.78	49.74	73.26
99	.04653	325.7	15.61	7.465	.2609	49.37	51.41	75.17
100	0.04805	336.4	15.63	7.698	0.2616	50.98	53.11	77.11
101	.04964	347.5	15.66	7.963	.2623	52.67	54.88	79.12
102	.05128	359.0	15.69	8.224	.2631	54.41	56.72	81.20
103	.05297	370.8	15.72	8.493	.2638	56.20	58.61	83.33
104	.05471	382.9	15.75	8.773	.2646	58.04	60.55	85.51
105	0.05649	395.4	15.77	9.059	0.2654	59.93	62.55	87.75
106	.05834	408.4	15.80	9.356	.2663	61.89	64.62	90.06
107	.06026	421.8	15.83	9.661	.2671	63.93	66.78	92.46
108	.06222	435.5	15.86	9.976	.2680	66.01	68.97	94.89
109	.06425	449.7	15.89	10.30	.2689	68.17	71.25	97.41
110	0.06635	464.4	15.91	10.64	0.2699	70.39	73.61	100.01
111	.06849	479.4	15.94	10.98	.2708	72.67	76.02	102.66
112	.07072	495.1	15.97	11.34	.2718	75.04	78.52	105.40
113	.07303	511.2	16.00	11.71	.2729	77.48	81.11	108.23
114	.07540	527.8	16.03	12.08	.2739	80.00	83.78	111.14
115	0.07784	544.9	16.05	12.47	0.2750	82.59	86.53	114.13
116	.08039	562.7	16.08	12.88	.2762	85.29	89.39	117.23
117	.08300	581.0	16.11	13.30	.2774	88.06	92.33	120.41
118	.08567	599.7	16.14	13.73	.2786	90.90	95.34	123.66
119	.08843	619.0	16.17	14.17	.2798	93.82	98.44	127.00

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(Tabulations for 22 in., 23 in., 24 in., 25 in. and 26 in. were published in July, August, September, October and November.)

Properties of Mixtures of Air and Saturated Water Vapor—(Continued)
Barometric Pressure 27 In. of Mercury

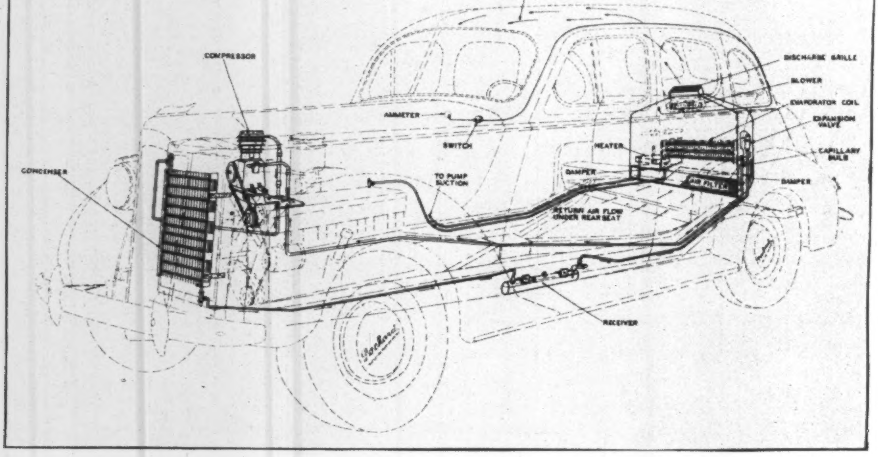
All tabulated values (except temperatures and pressures) are quantities per pound of dry air in the mixture.

Temp Deg Fahr	Absolute Humidity		Volume		Hum-id Spe-cific Heat	1061w	Enthalpy (Heat Content)	
	Pounds	Grains	Dry Air Cu Ft	Volume Increase of Humid Air Per Cent			Water Vapor Btu	Air-Vapor Mixture Btu
t	w	w	v_D		s''		h_V	h
1	2	3	4	5	6	7	8	9
120	0.09132	639.2	16.19	14.63	0.2811	96.89	101.70	130.50
121	.09428	660.0	16.22	15.10	.2824	100.04	105.04	134.08
122	.09730	681.1	16.25	15.59	.2838	103.24	108.44	137.72
123	.1005	703.4	16.28	16.09	.2852	106.61	112.03	141.55
124	.1037	725.2	16.30	16.62	.2867	110.07	115.70	145.46
125	0.1071	749.8	16.33	17.15	0.2882	113.64	119.51	149.51
126	.1106	774.2	16.36	17.71	.2898	117.35	123.45	153.69
127	.1142	799.5	16.39	18.29	.2914	121.18	127.53	158.01
128	.1179	825.4	16.42	18.88	.2931	125.11	131.72	162.44
129	.1218	852.4	16.44	19.50	.2948	129.20	136.07	167.03
130	0.1258	880.8	16.47	20.14	0.2966	133.51	140.67	171.87
131	.1299	909.6	16.50	20.79	.2985	137.87	145.31	176.75
132	.1341	938.6	16.53	21.47	.3003	142.27	150.01	181.69
133	.1385	969.7	16.56	22.17	.3023	146.98	155.03	186.95
134	.1431	1001.8	16.58	22.90	.3044	151.85	160.22	192.38
135	0.1478	1034.7	16.61	23.66	0.3065	156.83	165.53	197.93
136	.1527	1068.8	16.64	24.43	.3087	161.99	171.05	203.69
137	.1578	1104.3	16.67	25.24	.3110	167.38	176.82	209.70
138	.1631	1141.6	16.70	26.09	.3134	173.03	182.85	215.97
139	.1685	1179.4	16.72	26.95	.3158	178.76	188.97	222.33
140	0.1741	1218.7	16.75	27.85	0.3184	184.72	195.34	228.94
141	.1799	1259.2	16.78	28.78	.3210	190.85	201.90	235.74
142	.1861	1302.4	16.81	29.75	.3237	197.41	208.91	242.99
143	.1922	1345.7	16.84	30.75	.3265	203.97	215.92	250.24
144	.1987	1391.2	16.86	31.79	.3294	210.86	223.30	257.86
145	0.2055	1438.7	16.89	32.87	0.3325	218.07	231.04	265.84
146	.2127	1488.7	16.92	34.00	.3357	225.64	239.15	274.19
147	.2200	1539.9	16.95	35.16	.3390	233.41	247.47	282.75
148	.2276	1593.2	16.98	36.37	.3424	241.48	256.12	291.64
149	.2355	1648.3	17.00	37.64	.3460	249.83	265.07	300.83
150	0.2438	1706.6	17.03	38.96	0.3497	258.67	274.54	310.54
151	.2524	1766.7	17.06	40.33	.3536	267.78	284.31	320.55
152	.2610	1827.2	17.09	41.74	.3575	276.95	294.16	330.64
153	.2707	1894.6	17.11	43.24	.3618	287.16	305.10	341.82
154	.2804	1962.5	17.14	44.78	.3662	297.46	316.16	353.12
155	0.2906	2034.0	17.17	46.41	0.3708	308.29	327.79	364.99
156	.3012	2108.1	17.20	48.09	.3755	319.52	339.88	377.32
157	.3120	2184.1	17.23	49.84	.3804	331.04	352.26	389.94
158	.3237	2266.2	17.25	51.69	.3857	343.49	365.63	403.55
159	.3358	2350.7	17.28	53.61	.3911	356.29	379.40	417.56
160	0.3485	2439.6	17.31	55.63	0.3968	369.77	393.89	432.29
161	.3618	2532.4	17.34	57.74	.4028	383.84	409.02	447.66
162	.3758	2630.3	17.37	59.97	.4091	398.68	424.99	463.87
163	.3903	2732.4	17.39	62.28	.4157	414.15	441.63	480.75
164	.4057	2840.2	17.42	64.74	.4226	430.49	459.22	498.58
165	0.4219	2953.2	17.45	67.31	0.4299	447.61	477.65	517.25
166	.4390	3072.9	17.48	70.03	.4375	465.76	497.19	537.03
167	.4569	3198.1	17.51	72.87	.4456	484.74	517.63	557.71
168	.4759	3331.4	17.53	75.89	.4542	504.95	539.41	579.73
169	.4958	3470.9	17.56	79.05	.4631	526.09	562.18	602.74
170	0.5170	3619.1	17.59	82.43	0.4727	548.56	586.40	627.20
171	.5394	3775.5	17.62	85.97	.4827	572.26	611.96	653.00
172	.5632	3942.2	17.65	89.75	.4934	597.52	639.20	680.48
173	.5886	4120.0	17.67	93.80	.5049	624.47	668.26	709.78
174	.6155	4308.2	17.70	98.06	.5170	653.00	699.04	740.80
175	0.6438	4506.6	17.73	102.6	0.5297	683.07	731.49	773.49
176	.6743	4720.1	17.76	107.4	.5434	715.43	766.41	808.65
177	.7070	4948.8	17.79	112.6	.5581	750.10	803.83	846.31
178	.7418	5192.7	17.81	118.1	.5738	787.06	843.74	886.46
179	.7794	5455.9	17.84	124.1	.5907	826.95	886.74	929.70
180	0.8202	5741.4	17.87	130.6	0.6091	870.23	933.47	976.67
181	0.8638	6046.3	17.90	137.5	.6287	916.45	983.39	1026.8
182	0.9113	6379.4	17.92	145.0	.6501	966.93	1037.9	1081.6
183	0.9631	6742.0	17.95	153.3	.6734	1021.9	1097.3	1141.2
184	1.019	7133.7	17.98	162.1	.6986	1081.3	1161.5	1205.6
185	1.080	7562.1	18.01	171.8	0.7261	1146.2	1231.7	1276.1
186	1.148	8033.9	18.04	182.5	.7565	1217.7	1309.0	1353.6
187	1.222	8551.9	18.06	194.3	.7898	1296.2	1393.8	1438.7
188	1.304	9127.3	18.09	207.3	.8268	1383.4	1488.1	1533.3
189	1.396	9768.5	18.12	221.8	.8680	1480.6	1593.2	1638.6
190	1.498	10,486	18.15	238.1	0.9141	1589.4	1710.7	1756.3
191	1.614	11,295	18.18	256.4	0.9661	1712.0	1843.4	1889.2
192	1.745	12,213	18.20	277.3	1.025	1851.1	1993.8	2039.9
193	1.896	13,269	18.23	301.1	1.093	2011.2	2167.1	2213.4
194	2.070	14,487	18.26	328.8	1.171	2195.8	2366.8	2413.4
195	2.273	15,913	18.29	361.1	1.263	2412.0	2600.7	2647.5
196	2.515	17,602	18.32	399.4	1.372	2668.0	2877.7	2924.8
197	2.806	19,641	18.34	445.5	1.503	2977.1	3211.9	3259.2
198	3.163	22,138	18.37	502.0	1.663	3355.5	3621.5	3669.0
199	3.507	24,548	18.40	556.6	1.818	3720.7	4017.0	4064.8
200	4.186	29,304	18.43	664.2	2.124	4441.7	4797.1	4845.1

Packard Offers Automobile Air Conditioning System

The Packard Motor Car Co. has announced an automobile air cooling system which also filters the air and provides heating in winter. It is offered as a standard, factory installed, extra cost accessory.

The refrigerating coils are situated back of the rear seat in an air duct with heating coils in another compartment of the same duct. An electrically driven fan forces air through either set of coils at the will of the passengers, and the air is discharged upward from back of the rear seat. The air follows along the top of the car, and returns along the floor, passing under the rear seat to the coils for recooling or reheating and is then recirculated by the fan. The compressor is mounted on top of the engine and is driven from the radiator cooling fan. The system has a cooling capacity of 1½ tons at 60 mph and 2 tons at 80 mph.



AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

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BULLETIN BOARD

The Officers and members of the Council extend to all members of the Society cordial greetings for the Holiday Season and best wishes for a very Merry Christmas and a Happy New Year.

• • •

Membership of the Society now exceeds 3000—its finances are sound—research activity has expanded greatly this year—three successful national meetings have been held. The summary of 1939 accomplishments will be given at the Society's 46th Annual Meeting—January 22-25, in Cleveland, O. All members are urged to attend.

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A Study of Certain Factors That Affect the Droop Characteristics of Thermostats

By **Burton E. Shaw**[*] (*MEMBER*) **and LaVerne Lyon,**[**] **Goshen, Ind.**

IT is the purpose of this paper to study some of the factors affecting the droop characteristics of thermostats. Droop may be defined as the peculiarity of a thermostat to control the temperature adjacent to its location at a point below the setting (dial adjustment) under certain conditions.

Droop may be affected by artificial heat developed within the thermostat, wall-temperature conditions, thermostat mass, air drift through the thermostat, heat-gain rate of the system, heat-loss rate of the system, and many other factors. Because of the necessary limitations of the paper the authors will confine their comments to a study of droop conditions occasioned by using artificial heat within the thermostat, the effect of cold wall conditions, and the effect of variations in the rate of indoor temperature changes.

The rate of heating and cooling in an average residence may vary from one degree Fahrenheit per hour to 10 F or more, depending on weather conditions, insulation, and other factors. In order to study the droop for various rise and fall rates special test equipment was constructed as shown in Figs. 1, 2, 3 and 4.

Essentially the test apparatus consisted of a large cooling room within which a smaller insulated structure housed the thermostat, heating means and air velocity regulator. The temperature in the cooling room was maintained by a compressor with an adjustable thermostatic control. The heating means in the smaller enclosure which simulated the residence to be tested was controlled through a relay by the thermostat located therein. The heat input was regulated by a variable voltage transformer located externally to both enclosures. Temperatures within the residence were measured on a recording instrument with a 60—80 F scale calibrated to 0.2 F. A temperature recorder in the larger enclosure (outdoors) was also used.

The small structure was lightly insulated so that the rates of temperature changes inside could be regulated with a minimum change of outdoor temperature. Thus the radiation effect to cold outside walls and windows was minimized. Cold wall mass effect was eliminated by hanging the thermostat in air near the center of the box.

The capacity of the thermostatically controlled cooling system was large enough to hold a constant outside temperature despite any influence of the heat loss from the smaller structure.

In the field a variable amount of under-run and over-run of the heating system may occur. With the apparatus used this factor was reduced to a minimum thus eliminating another variable.

Cold walls were made the subject of a separate test. The method and apparatus used is shown in Figs. 5, 6 and 7. The apparatus consisted of an insulated wall on which the thermostat was mounted. Within the wall was located a water coil through which water at a constant temperature was circulated. The temperature of the water was regulated by means of a limit switch controlling within 0.1 F. The thermostat controlled the ambient temperatures adjacent to itself and the wall.

Throughout the tests outlined artifically heated thermostats were used. The thermostats could be adjusted readily to give differentials ranging from conventional control (3 F or more) to line temperature control[1] (½ F or less).

Various designs are resorted to by different manufacturers but suffice it to say that in all cases investigated the results obtained did not differ materially from those reported on except in cases wherein the thermostat was definitely defective in design or performance.

Results

The rate of temperature rise in degrees per hour plotted against the operating temperatures of the thermostat is shown in Fig. 8. By operating temperature is meant the maximum and minimum temperature of the controlled air adjacent to the controlling thermostat. In other words the ambient temperatures at which the thermostat opens and closes. To obtain a variation in temperature rise the heat source in the small structure corresponding to the residence was varied to produce average rates of rise of indoor temperature from one to 16 F per hour. The outdoor temperature was held constant to give a 6 F per hour fall. Thus, the sole effect of variation of temperature rise on the operation of the thermostat is shown by these curves. Two tests were run, one without an artificial heater, and the other with an artificial heater. The thermostat operating without an artificial heater corresponded to a conventional type thermostat except that its differential was somewhat wider than will ordinarily be found with these thermostats.

Identical tendencies of the operating characteristics occur with various differential settings of a conventional thermostat. For the purpose of obtaining the total influence of the artificial heat on the thermostats tested the mechanical differential was held the same for the tests with and without the artificial heater. This resulted in greater contact pressures and snap of contacts as compared to a conventional unit.

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[*] Research Chief, Penn Electric Switch Co.

[**] Research Engineer, Penn Electric Switch Co.

Presented at the Fall Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Atlanta, Ga., October, 1939.

[1] Comparative Study of Combustion Results with Various Thermostats, by B. E. Shaw. (ASHVE TRANSACTIONS, Vol. 42, 1936, p. 60).

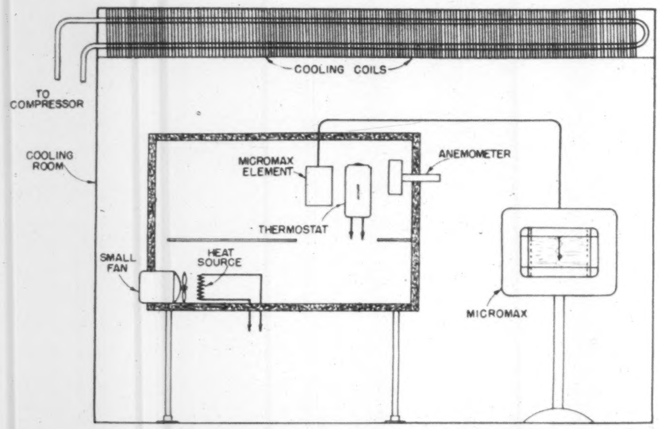
COOLING COILS
TO COMPRESSOR
COOLING ROOM
MICROMAX ELEMENT
ANEMOMETER
THERMOSTAT
SMALL FAN
HEAT SOURCE
MICROMAX

Fig. 1—Temperature droop test apparatus

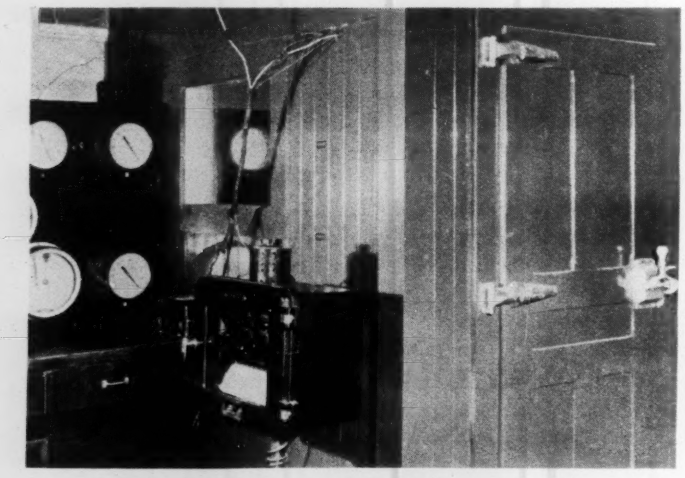

Fig. 2—Exterior view of cooling room

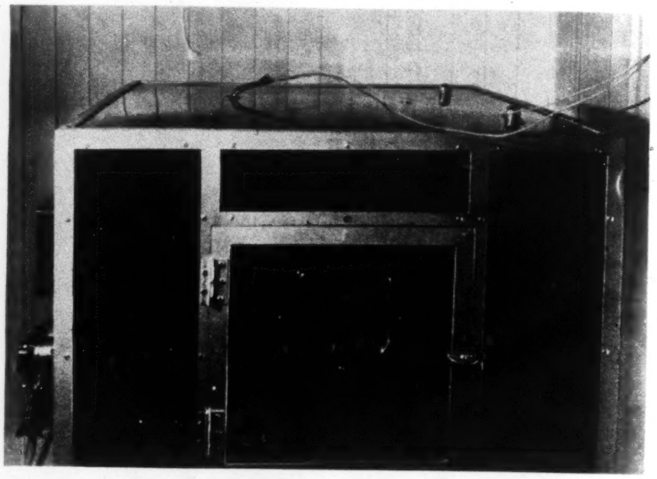

Fig. 3—View of insulated structure housing thermostat

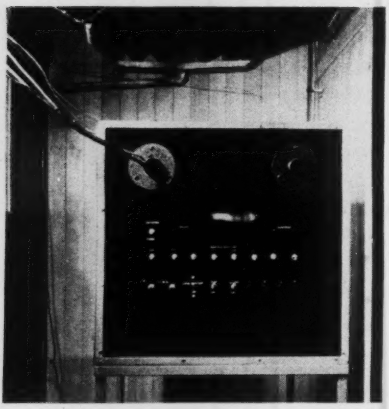

Fig. 4—End view of control panel on insulated structure

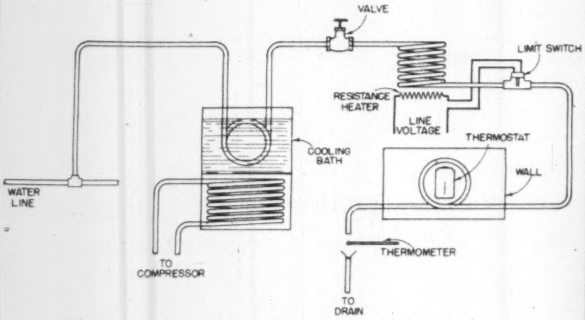
VALVE
LIMIT SWITCH
RESISTANCE HEATER
LINE VOLTAGE
THERMOSTAT
COOLING BATH
WALL
WATER LINE
TO COMPRESSOR
THERMOMETER
TO DRAIN

Fig. 5—Cold wall temperature test apparatus

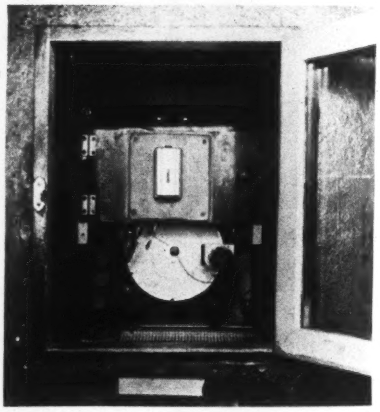

Fig. 7—Close up view of cold wall apparatus

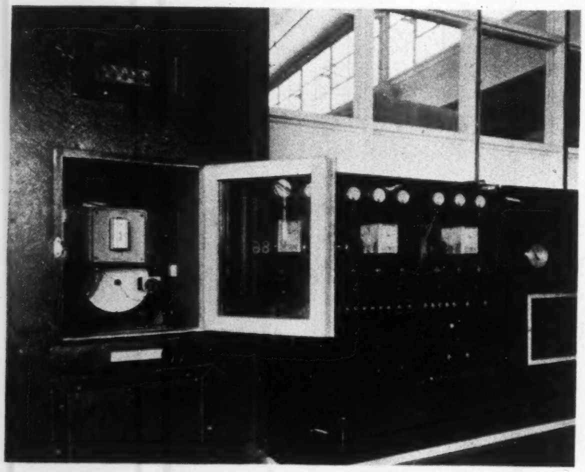

Fig. 6—View of cold wall temperature test equipment

The heaters consisted of a resistance wire series connected with the load, whenever the thermostat called for heat. The resistance wire supplied approximately one-fourth watt of artificial heat to the thermostat. For the test without artificial heat a copper jumper was substituted for the resistance wire.

An analysis of these curves follows: Curves *A* and *C* show the opening and closing temperatures with artificial heat. With the slower rates of heat rise and consequent longer *on* periods, the closing temperatures of the thermostat decreased slightly more than 1 F below the true setting (closing temperature in water) at a temperature change approaching zero degrees per hour. This means that artificial heat is retained in the thermostat throughout the *off* period, and a greater lowering of temperature outside the thermostat is necessary to close it. Curves *B* and *D* show the closing and opening temperatures when the artificial heater is removed. The difference between Curves *A* and *B* is a measure of the heat retention in the mass of the thermostat due to the artificial heater. Curves *C* and *D* show considerable drop of the opening temperatures of the thermostats as the rate of temperature rise decreases. Curve *C* drops somewhat more acutely than does Curve *D*. The difference is due to the artificial heater used in obtaining Curve *C*. The decrease of both Curves *C* and *D* was the result of the natural lag of the thermostat behind the rise in temperature. Decrease of Curve *C* more than Curve *D* shows that during a short *on* period the artificial heater did not increase the artificial temperature within the thermostat as much as it did during longer *on* periods. Point *X*, the intersection of Curve *C* with the closing point of the thermostat in water shows that an *on* period of four or five hours was necessary before the thermostat opened below its true setting. Curve *D* straightens out near the ordinate axis at low rates of rise indicating that up to about a 2 deg per hour change the thermostat was able to follow air temperature changes very closely. Fig. 9 shows the operating characteristics of a thermostat as altered by the variations in indoor temperature fall only. These data were then added to Fig. 8 to obtain Fig. 10.

Fig. 10 is a mathematical combination of Figs. 8 and 9 giving the normal droop of the thermostat from mild outside temperatures to cold outside temperatures. Under normal conditions the rates of rise and fall of inside temperature vary conversely as the outside temperature changes. Therefore, by adding the Curve of Fig. 8 to Fig. 9 within the limits of 1 to 11 F per hour rate of temperature change, an effect equivalent to a range of outdoor temperatures is produced on the thermostat. This particular rate range was chosen arbitrarily. Any greater or smaller range might have been used resulting in more or less droop of the thermostat. In the field a different range of temperature change is found with every individual installation. However, since the slower changes had the most effect on droop it was felt that the values used in this paper produced close to the maximum.

As shown in Fig. 11 the temperature droop in one continuous test where the outdoor temperature was varied gave practically identical results as compared to Fig. 10. This droop amounted to approximately 3 F maximum for the total range investigated. It is to be noted from Curve in Fig. 11 that the changes in rates from mild to cold weather were produced by total outside temperature change of from 65 to 48 F. The same change in rates in an actual field installation may be the result of an outside temperature change of from 65 deg F to below zero depending on the heating system, building, insulation and other like factors.

Fig. 12 was adopted from Fig. 8 and shows the changes in differential under various rates of temperature rise. Different heating systems produce a rate of temperature rise somewhat in the order shown in Fig. 12. Thus, the same thermostat on one setting or adjustment may have a differential of from ½ to 3 F (if it is of the artificially heated type) depending on the type of system used. It is not uncommon for a field installation to require an adjustment of the thermostat differential to suit the particular requirements of that installation. The velocity of air motion produced by various systems has some effect on the differential of the thermostat and also on droop. A study of this factor is being reserved for a later paper. These tests were made at an air velocity of approximately 8 fpm.

Fig. 13 shows temperature lag of the thermostat as a whole behind the ambient air temperature at various rates of change when no artificial heat was used. The opening and closing temperatures lagged because of a combination of the slow infiltration of the ambient air through the thermostat cover and the thermal lag of the bimetal.

Fig. 14 is based on the effect of artificial heat on the opening point of the thermostat, and is taken from Fig. 10. It shows the temperature rise within the thermostat resulting from the artificial heating. The difference between the opening curve with and without artificial heat is caused by the temperature rise in the thermostat resulting from heat artificially put in. The important point to be gained from this curve is that most of the effect of the artificial heat is felt within the first 20 min of operation. For longer *on* periods the curve straightens out with only a very slight rise. An ideal heater would have all of its effect felt immediately after the thermostat closes and thereafter supply a heat input of just enough to hold the temperature gained, thus reducing the possibility of the thermostat opening without a rise in room temperature. Fig. 14 shows that the thermostat tested approached this ideal very closely.

Cold Wall Effect

Fig. 15 is a room temperature chart showing the changes that occurred in the operating temperature of a thermostat when the temperature of the wall on which the thermostat was mounted varied. A change of 5 deg in wall temperature caused a 2 F change in the operating points of the thermostat, both closing and opening. As the temperature of the wall went up from 65 to 70 F the air temperature as controlled by the thermostat decreased. Since the wall temperatures ordinarily decrease as the outside temperatures become colder, the thermostat will operate at a high temperature. Thus, cold wall effect is opposite to the effect of the rate of indoor temperature change. Droop resulting from one is at least partly off-set by the other.

Fig. 16 shows sections of room temperature charts where the operation of night-setback (NSB) under various conditions took place. These were taken from the

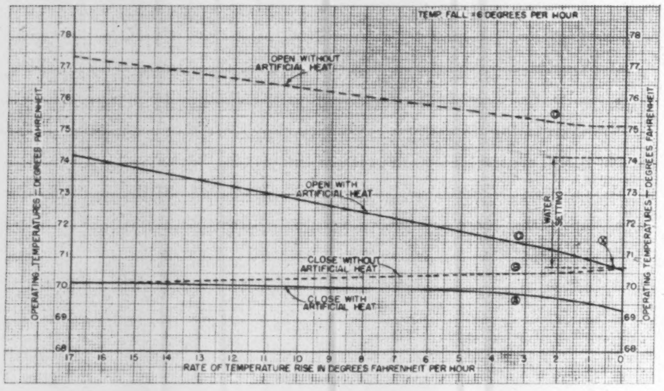

Fig. 8—Effect of rate of temperature rise on a thermostat

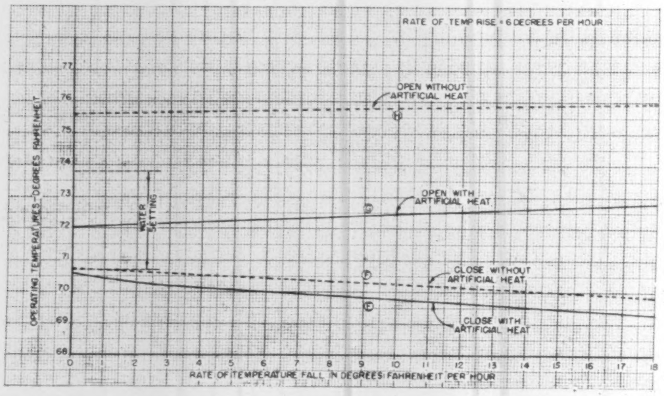

Fig. 9—Effect of the rate of temperature fall on a thermostat

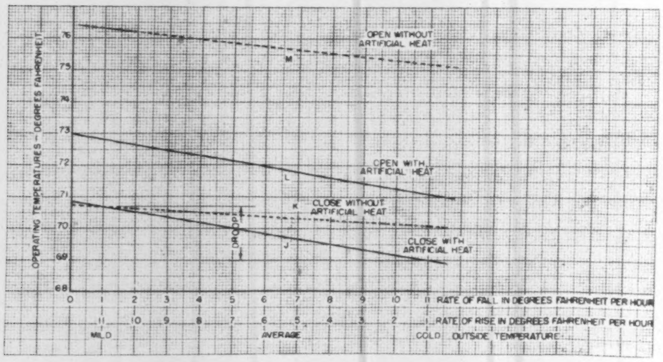

Fig. 10—Temperature droop of a thermostat computed from curve

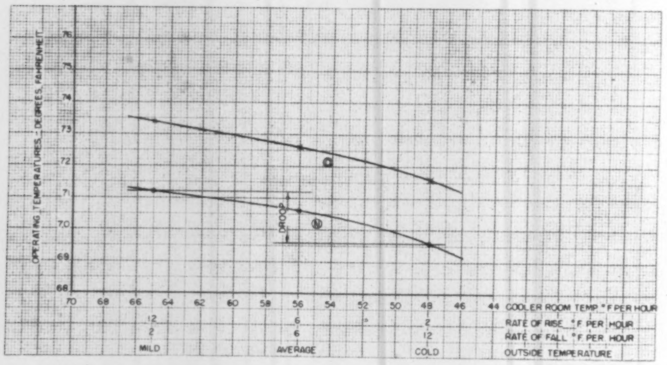

Fig. 11—Temperature droop of a thermostat actual test

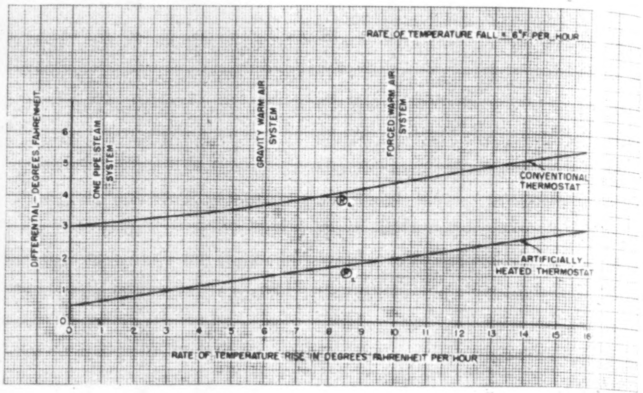

Fig. 12—Differential of a thermostat with various rates of rise

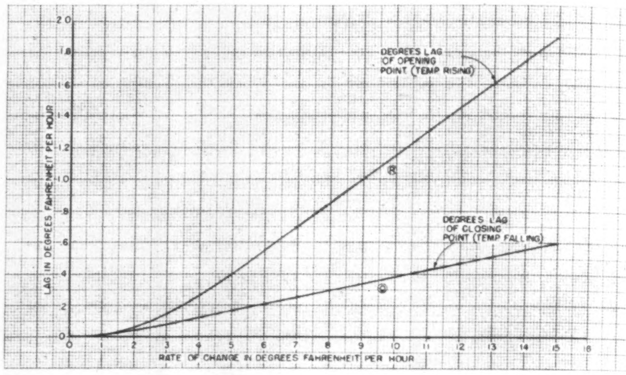

Fig. 13—Lag of the thermostat behind the ambient temperature, no artificial heat

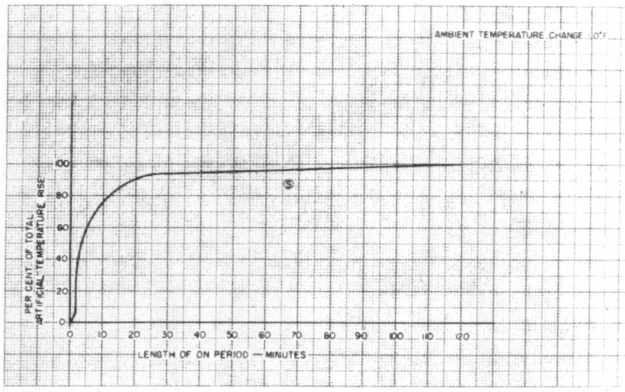

Fig. 14—Temperature rise within the thermostat from the artificial heater

field during previous investigations by the authors. Fig. 16A depicts night-setback with sufficient artificial heat in proportion to the normal differential of the thermostat to produce nearly straight-line temperature operations. No over-run occurred because of the snubbing effect of the artificial heat helping the thermostat to open at its normal setting despite the fact that cold walls and thermal inertia of the thermostat tended to keep it closed and cause over-shooting.

In Fig. 16B and C over-shooting occurred where the ratio of the artificial temperature rise to the real differential of the thermostat was smaller allowing wider actual differentials. In other words because of the lag in bimetal temperature from cold wall conduction and slow infiltration of ambient air the room temperature

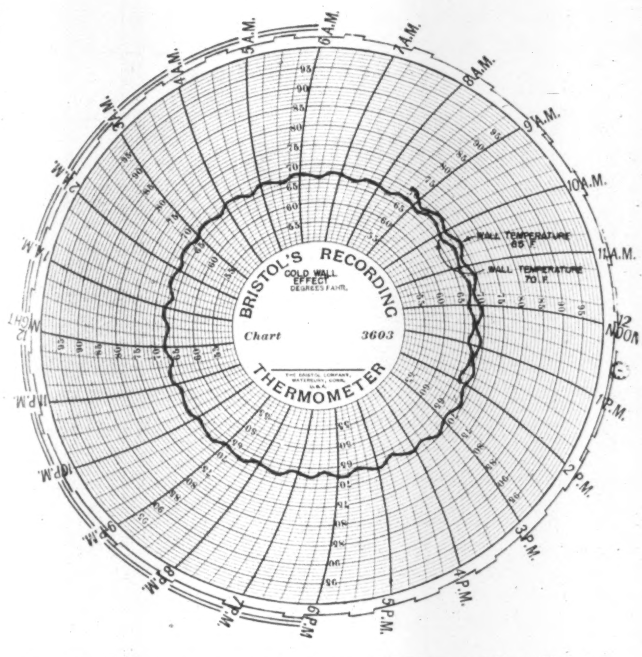

Fig. 15—Room temperature chart showing cold wall effect

was allowed to rise above the temperature setting of the thermostat before it opened to shut down the heating system.

Conclusions

1. From the standpoint of thermostat design, droop is caused primarily by slow infiltration or drift of air into the thermostat and thermal inertia of the bimetal and thermostat mass. This factor was equally effective in both artificially heated and conventional designs.

2. Some droop is caused by the use of artificial heat in a thermostat because of heat retention or carry-over through the *off* period after moderately long *on* periods. Another factor of least importance in producing droop is the effect of artificial heat on the opening temperature of the thermostat. With a correctly designed heater most of the artificial temperature rise within a thermostat takes place during the first few minutes of the *on* period. Thereafter the temperature gain is slight and has little further influence on the droop of the thermostat.

3. The effect of cold walls on droop is opposite to that of the factors of thermostat lag and artificial heat. As the weather becomes colder and the wall temperatures decrease the thermostat influenced by such cold walls tends to operate at higher temperatures. Thus the effect of cold walls is to partly off-set the droop of a thermostat.

4. Artificial heat in thermostats tends to decrease the morning over-run after a setback of temperature at night caused by cold walls, and air drift lag of the thermostat.

5. Test data not yet completed indicate all types of artificially heated thermostats regardless of design or circuit method apparently will function to give the same general characteristics. With one type, however, the results were negative due to improper design and faulty performance.

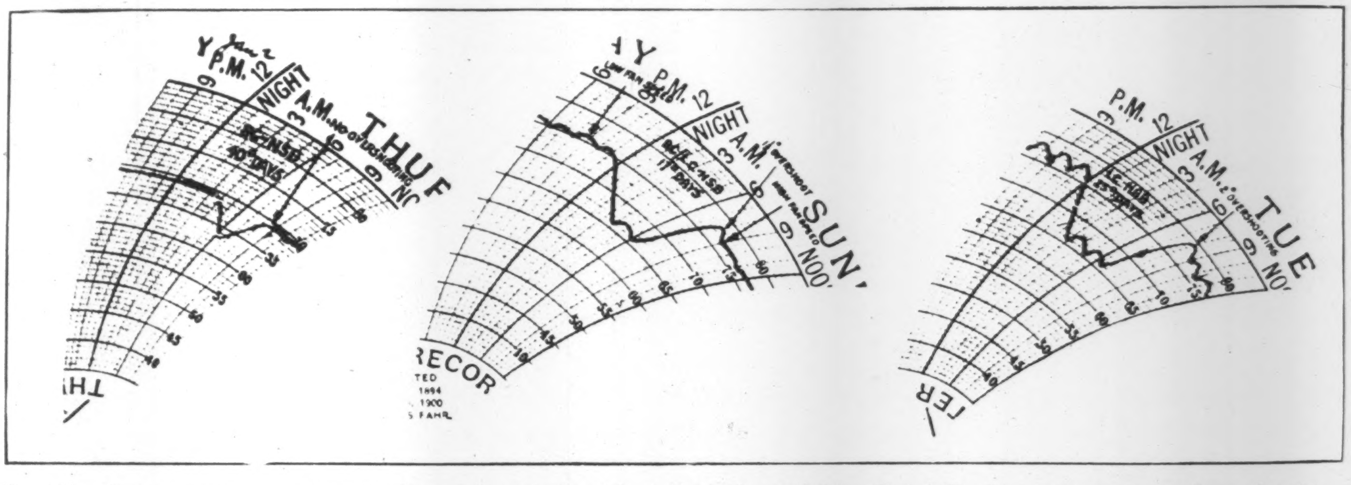

Fig. 16A—Room temperature chart showing night setback with artificial heat (left). Fig. 16B—Room temperature chart showing night setback with overshooting (center). Fig. 16C—Room temperature chart showing night setback with overshooting (right)

ASRE Will Celebrate 35th Anniversary

An interesting ceremony commemorating the 35th anniversary of the founding of the *American Society of Refrigerating Engineers* will be one of the outstanding features of the Annual Meeting of the *ASRE* which is to be held in Chicago, January 17-19, 1940, with headquarters at the Blackstone Hotel. Other programs will be devoted to the latest practice in industrial refrigeration, domestic-commercial refrigeration, and meat refrigeration, and Thursday morning, January 18, will be given over to two informal conferences, one on corrosion problems, and another on the timely and significant subject of refrigeration research in agriculture.

Social events at the 35th Annual Meeting will be directed by Deane Perham and B. E. Seamon, chairman and secretary of the Chicago Section of the *ASRE*, with members of the Chicago group serving as a reception committee. Special interest is attached to this meeting also since it coincides with the Second Exhibition staged by the Refrigeration Parts Manufacturers' Association.

Permissible Relative Humidities in Humidified Buildings

By Paul D. Close,* (*MEMBER*), Chicago, Ill.

THE increased use of winter air conditioning involving humidification of buildings has introduced certain condensation problems. These problems are of two types, namely (1) condensation within the insulating and building materials, sometimes referred to as interstitial condensation, and (2) surface condensation or the precipitation of moisture on the interior building surfaces.

The first problem has engaged the attention of interested individuals in the past few years and many research investigations have been made, notably at the University of Minnesota, Minneapolis, and at the U. S. Forest Products Laboratory, Madison, Wis. The results of these studies have been reported from time to time. The present paper deals with the second problem or condensation on interior wall, glass and ceiling surfaces with particular reference to the maximum humidities that can be maintained to preclude condensation. Such condensation is not only annoying but often is the cause of damage to the interior decorations as well as to structural materials, and therefore should be prevented wherever possible.

Fundamentals Reviewed

Condensation takes place on the interior surfaces of a building whenever such surfaces are below the dew-point temperature. For example if the atmospheric conditions are a temperature of 70 F and a relative humidity of 45 per cent, the dew-point temperature will be 47.5 F and moisture will be condensed on any surface below this temperature.

The governing factors in the problem are of course the relative humidity, the inside and outside temperatures, and the construction of the exterior walls, roof and glass, or more particularly the heat resistance of these parts of the building. The probability of condensation increases with the inside-outside temperature difference, with the relative humidity and with the rate of heat transfer through the structural members. Thus if the relative humidity and inside temperature are fixed, the probability of surface condensation increases as the outside temperature diminishes. On the other hand, for given inside and outside temperatures, the probability of surface condensation increases as the relative humidity increases. And, since those parts of the structure having the highest rate of heat transfer, that is, the least heat resistance, are the coldest, they are the most susceptible to condensation. For this reason, moisture and frost will precipitate on single-pane windows at comparatively low humidities during cold weather and usually they are the limiting factor as to the relative humidity which can be maintained, if condensation is to be avoided.

Temperature Gradient

Problems of this character may be readily solved mathematically. The calculation of the resistance required to prevent surface condensation is based on the principle that the temperature gradient is proportional to the resistance. For example, if the over-all temperature difference is 100 deg and the total resistance (including the inside and outside surfaces) is 10, there will be a change or gradient of 10 deg for each unit of resistance. Or if the temperature difference is 70 deg and the over-all resistance is 10, there will be a gradient of 1/10 of 70 or 7 deg for each unit of resistance.

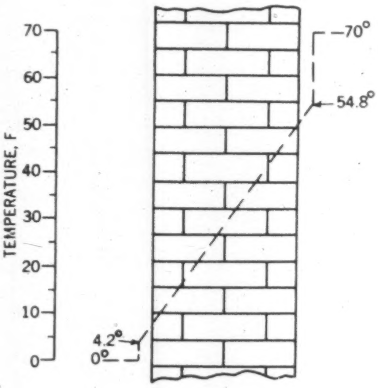

Fig. 1—Section through 12-in. brick wall showing temperature gradient for equilibrium

This principle may be more readily illustrated by a specific construction, a 12-inch solid brick wall as shown in Fig. 1. If the over-all temperature difference is 70 deg, the proportionate temperature changes for the component resistances of the structure are as follows:

	RESISTANCES	TEMPERATURE CHANGE, DEG
Inside Surface	0.61	15.2
12-inch Solid Brick [1]	2.04	50.6
Outside Surface	0.17	4.2
Totals	2.82	70.0

[1] Based on 4-in. face brick (resistance = 0.44) and 8-in. common brick (resistance = 1.60).

The inside surface temperature is determined by subtracting the temperature change or drop of 15.2 deg for the inside surface from the inside temperature of 70 F and is 54.8 F. Similarly the outside surface temperature is obtained by adding the temperature change to the outside temperature and is 4.2 deg. These various temperatures are indicated in Fig. 1.

Any increase in the total resistance of a wall or roof has a tendency to increase the inside surface temperature, or to make the surface *warmer*. This fact may readily be verified by increasing the total resistance in the example just cited and noting that the inside surface temperature increases as this total resistance increases, for the same inside and outside temperatures. If the total or over-all resistance were 5.0 instead of 2.82, the

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*Insulation Board Institute

Presented at the Fall Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Atlanta, Ga., October, 1939.

inside surface temperature would be approximately 61.5 F instead of 54.8 F.

Resistance Required to Prevent Condensation

Knowing the inside air temperature (t) and the dew-point temperature (t_d), the problem is to calculate the required resistance of the wall or roof structure to maintain the inside surface temperature at or above the dew-point temperature so that moisture will not condense on this surface. The total required resistance to prevent surface condensation is expressed by the following proportion:

$$\frac{R_t}{R_s} = \frac{(t - t_o)}{(t - t_d)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where

R_t = Total or over-all resistance required to prevent surface condensation

R_s = Inside still-air surface resistance

$= \frac{1}{f_i} = \frac{1}{1.65}$ (for average surface)

$= 0.61$

t = Inside temperature near surface involved.

t_o = Minimum outside temperature

t_d = Dew-point temperature based on inside temperature (t) and the correct relative humidity (or wet-bulb temperature).

For the average still-air surface resistance of 0.61, the value of R_t may be expressed as follows:

$$R_t = \frac{0.61\,(t - t_o)}{(t - t_d)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Example. Calculate the required resistance of a wall to prevent surface condensation for an inside temperature and relative humidity of 70 F and 61 per cent, respectively and an outside temperature of —10 F.

Solution.

$t = 70$

$t_o = -10$

$t_d = 55.3$

Substituting these values in Equation 2, the required resistance to prevent surface condensation is:

$$R_t = \frac{0.61\,[70 - (-10)]}{70 - 55.3} \quad \ldots\ldots\ldots\ldots (3)$$

$$= 3.33$$

The walls and roof must have a coefficient of transmission not to exceed $\frac{1}{3.33}$ or 0.30 in order to avoid surface condensation for these conditions.

Note. This chart is based on an average still-air surface conductance of 1.65 or a resistance of 0.61, the value used for computing the heat transmission coefficients in the HEATING, VENTILATING, AIR CONDITIONING GUIDE 1939. The surface conductances of individual materials may deviate from this value and will also vary with the mean temperature. It is possible, therefore, that the results will deviate somewhat from the chart values in specific cases where the actual surface resistance is greater or less than 0.61. If the surface resistance is greater than 0.61 (the conductance being less than 1.65), a greater total resistance will be required to prevent surface condensation as is apparent from an examination of equation 2, or for the same total resistance and the same temperature conditions, a *lower* relative humidity would be permissible to avoid surface condensation. If there is a substantial departure in the actual known surface resistance from that used for developing the curves of Fig. 2, more accurate results will, of course, be obtained by substituting the proper values in equation 2. The chart will, however, give satisfactory results in the majority of cases where an approximation is sufficient.

Condensation Chart

Fig. 2 is based on the foregoing relationship and may be used for ascertaining whether or not condensation will take place on any given surface for specified temperature and humidity conditions. All points on or above any given outside temperature curve are condensation points for that outside temperature, whereas all points below any given curve indicate conditions under which condensation will *not* take place for that outside temperature. The curve for an outside temperature of —10 F indicates that condensation will take place when the relative humidity is 60 per cent or higher if the wall or roof coefficient of transmission is 0.30 or higher. If the humidity is below this value or the wall or roof coefficient is less than 0.30, there will be no condensation when the outside temperature is —10 F or higher.

The vertical line on the right shows the location of the single glass coefficient of 1.13. It is apparent that condensation will take place on single glass at comparatively low inside relative humidities during cold weather and, as previously indicated, such surfaces are therefore the limiting factor with respect to the humidity which can be maintained to avoid condensation. For example, condensation, which would become frost, would take place when the outside temperature is zero and the inside relative humidity is only 15 per cent. If double glazing or storm sash were used there would be no condensation on the windows at this humidity; in fact the relative humidity could be in excess of 50 per cent when the outside temperature is zero, or approximately 38 per cent when the outside temperature is —30 F.

The permissible relative humidity for any specific type of construction may be determined by first ascertaining the coefficient of transmission of the construction from any standard reference volume such as the HEATING, VENTILATING, AIR CONDITIONING GUIDE 1939 and then locating this coefficient on the horizontal scale as shown in Fig. 2. A vertical line drawn to the proper outside-

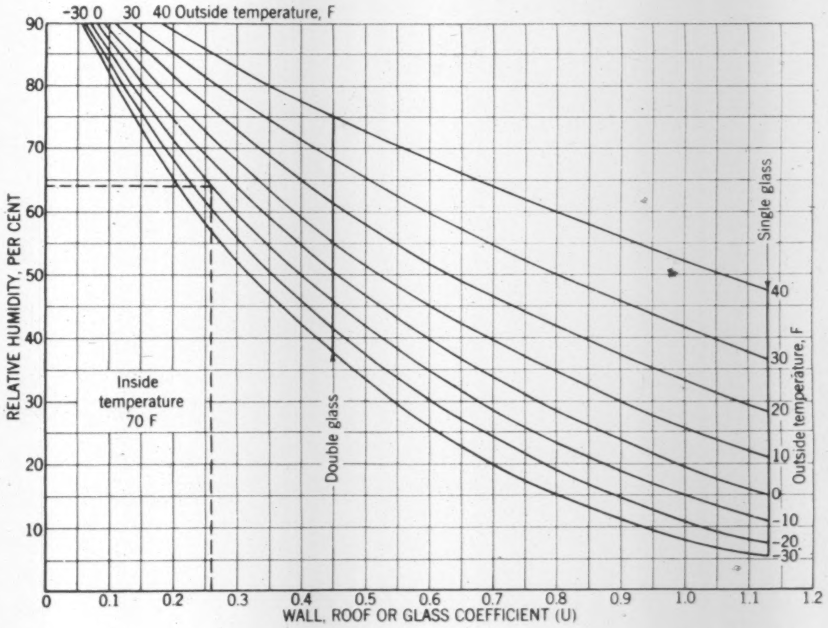

Fig. 2—Curves indicating conditions under which condensation will take place in building

temperature curve and then to the left hand scale will indicate the permissible relative humidity for the conditions involved. The dotted line shown in Fig. 2 indicates the permissible relative humidity, 64 per cent, if surface condensation is to be avoided, for a frame wall having a coefficient of 0.26 and for an outside temperature of —10 F.

It is apparent from Fig. 2 that there is little likelihood of condensation taking place on properly insulated walls and ceilings where only ordinary inside relative humidities are maintained. By *ordinary* is meant humidities of approximately 35 to 45 per cent, commonly maintained in humidified or winter air conditioned residences or other structures.

Industrial Buildings

These curves may also be used for determining the required wall or roof coefficients necessary to preclude surface condensation in industrial buildings where high humidities are either maintained for, or result from, certain manufacturing processes. If a relative humidity of approximately 80 per cent is maintained in a certain plant and the minimum outside temperature is —10 F, the walls and roof will require a transmission coefficient not to exceed 0.13, and sufficient insulation should be installed to reduce the wall and roof coefficients to this value.

Attention is called to the fact that Fig. 2 is based on an inside temperature of 70 F, which approximates the average inside temperature in residences. If the inside temperature is greatly in excess of this value, the outside temperature used in the problem should be *decreased* by an amount equal to the difference between the actual inside temperature near the surface involved and 70 F. For example, if the inside temperature is 80 F and the minimum outside temperature is —10 F, use the —20 F curve for arriving at the required wall or roof coefficient to prevent surface condensation. There will be a slight error resulting from this procedure due to the fact that the difference between the dry-bulb and dew-point temperatures varies with the dry-bulb temperature for any given relative humidity. The error, however, is not sufficient in most cases to affect the result seriously. Conversely, if the inside temperature is below 70 F, the outside temperature used in solving the problem should be *increased* by the amount of the difference; in other words, a correspondingly higher outside temperature should be used.

Vermilye Medal to Lewis H. Brown

The Franklin Institute of the State of Pennsylvania made the first award of the Vermilye Medal "in recognition of outstanding contribution in the field of industrial management," to Lewis H. Brown, president of Johns-Manville Corp., New York, in Philadelphia, Pa., Tuesday, November 14, 1939.

Named after its donor, William M. Vermilye, vice-president, The National City Bank of New York, the medal is purposed to stimulate, encourage and recognize outstanding contributions in the field of industrial management not only in the United States, but in other countries as well.

In accepting the medal, Mr. Brown outlined the qualifications of the new profession of scientific management, as well as a three-fold problem faced by industry. He also stated that work must be found for millions of unemployed and genuine security established which is dependent upon jobs and not upon the payment of government benefits for idle men and idle land. He also pointed out that the American enterprise system must be restored through applied scientific research and the stimulation of new business ventures to a basis where government spend-lend respirators can be finally and permanently dispensed with. The purchasing power of the public, Mr. Brown concluded, must be increased by continuing to produce more goods at lower prices, and by reducing the burden of taxation, which now consumes nearly a third of the national income and would take more if we were on a pay-as-you-go basis.

The decision to honor Mr. Brown was made by the Board of Managers of The Franklin Institute acting on the recommendation of a sub-committee of its members, including Conrad N. Lauer, chairman, president of the Philadelphia Gas Works Co.; Edward G. Budd, president of the Edward G. Budd Mfg. Co.; Charles Penrose, vice-president of Day and Zimmermann, and Dr. Henry Butler Allen, secretary and director of The Franklin Institute.

The action of this Committee was based on the report of the Vermilye Medal Advisory Committee composed of William L. Batt, chairman, president of SKF Industries, Inc.; Charles E. Brinley, president of the Baldwin Locomotive Works; H. R. Martz, executive vice-president, Day and Zimmermann; Prof. J. W. Roe, former professor of industrial engineering, New York University; R. A. Wentworth, representing the *American Society of Mechanical Engineers;* John W. O'Leary, the Chamber of Commerce of the United States; and Charles W. Hook, the *National Association of Manufacturers.*

Mr. Brown is a native of Iowa, and was graduated from the State University of Iowa in the class of 1915. Upon graduation he entered the paper manufacturing industry in Indiana, until the entrance of the United States into the World War, and served as a Captain of Infantry with the A.E.F. in France. Returning in 1919 to the U.S., he was identified with Montgomery Ward Co. during the eight years following. In 1927 Mr. Brown became the assistant to the president of Johns-Manville Corp., and two years later, in 1929, the president of that organization. He is director of numerous corporate interests, including New York Telephone Co., Mutual Life Insurance Co., and Bankers Trust Co. In 1933 he served as president of the Asbestos Institute. Mr. Brown has been identified with public-spirited enterprise, including chairmanship of Noise Abatement Commission of New York City; and service on the President's Emergency Commission for Employment (1930-1931), Durable Goods Industries Commission, and is now General Chairman of the American Red Cross Roll Call for New York City. He had an influential part in the 7th International Management Conference, held at Washington in 1938.

The Vermilye Medal implies a tribute to the practical idealism of Dr. Benjamin Franklin, for the obverse side of the medal reveals the likeness of America's great printer, patriot, sage and scientist as immortalized by James Earle Fraser in the heroic statue which is enshrined in the national Benjamin Franklin Memorial in Philadelphia. The medal, of bronze, was designed by Gerald K. Geerlings and executed by Allen Townsend Terrell, sculptor. The reverse bears the following inscription: "Awarded by The Franklin Institute of the State of Pennsylvania in recognition of outstanding contribution in the field of industrial management to Lewis H. Brown."

ASA Annual Meeting

The annual meeting of the *American Standards Association* will be held at the Hotel Astor, New York, N. Y., on Wednesday, December 13, 1939, according to a recent announcement by Cyril Ainsworth, assistant secretary of the Association.

Agriculture Has Engineering Problems in Heating and Ventilating

By Frank B. Lanham,* Athens, Ga.

Introduction

An improved standard of living for the rural people of this country has been the subject for much popular discussion and legislation. Approximately 75 years ago by an Act of Congress land grant colleges had their birth. At present an agricultural institution is located in each state with the purpose of offering resident instruction, the conducting of research and investigational programs through experiment stations and branches, and the dissemination of agricultural knowledge to the farmers of the state through an extension service program.

The purpose of this paper is to review a few problems in agriculture which involve heating and ventilating practices and indicate how the influence of heating, ventilating and air conditioning engineers can improve comfort and efficiency on the farm. The usual work in these fields entails installations in factories, offices, public buildings and often in urban developments of rather mammoth proportions. On the other hand the agricultural engineer finds that a great number of his problems involve principles of heating, ventilating and air conditioning of a specialized nature.

Rural Population in the United States

Perhaps when the term, agricultural conditions, is mentioned many specialists and technicians in those fields not directly or intimately related to agricultural activities think of it in passing as a vague term—something in which they at best are only mildly interested. Yet the fact cannot be escaped that 40 per cent of the people in these United States are rural whereas in Georgia this figure increases to approximately 70 per cent. Of the 157 counties of the state 100 are classed as entirely rural by the U. S. Bureau of the Census.[17] The fact is a very obvious one that this great proportion of the population is to be reckoned with, that engineers must recognize the potentialities of this group and strive to bring them to a standard of living equivalent to the urban population. As yet the field is surprisingly undeveloped and a prediction could perhaps be safely made that the activities of the heating, ventilating and air conditioning profession may soon embrace at least certain phases of the agricultural picture. Becoming more specific the total value of farm lands and buildings in the United States during 1935 was $32,589,000,000[14] with buildings representing roughly 15 per cent of this amount, or more than the combined value of implements, machinery and livestock.

Rural Housing

The development of a satisfactory rural housing program has been less rapid in the United States than in European countries. Slum clearances in the larger cities have been somewhat gigantic and spectacular, but the country areas have experienced but little aid from large scale housing programs. Statistics[15] indicate that the magnitude of the housing problem in the rural areas of the south is as great and equally as challenging as any of the slum clearing projects. According to figures released in 1934 by the Farm Housing Survey 79 per cent of farm houses in Georgia were unpainted, 40 per cent had poor roofs, 83 per cent had outdoor toilets with 96 per cent of these of the unimproved type, 16 per cent had no toilets, 1 per cent had bathtubs, 2½ per cent had kitchen sinks and less than 1 per cent had a central heating system.

It is too often assumed that climatic conditions in the south are far milder than they really are. Atlanta has an average of 2890 degree-days[1] or 45 per cent as many as Des Moines, Ia., with 6384. An interesting case is Athens, Ga., where 15 years ago a house with a central heating system was scarcely available although today central heating is demanded by the family in only moderate financial circumstances. Climatic conditions in the southern part of the United States vary widely, making general recommendations impossible. However, one definite fact is that over the greatest portion of this area some method of heating the home other than the grate or open fireplace is essential to a satisfactory standard of living.

The U. S. Department of Agriculture, Bureau of Agricultural Chemistry and Engineering, is at the present time cooperating with the Departments of Agricultural Engineering at the University of Wisconsin, Madison, and the University of Georgia, Athens, in making some observations on the causes and extent of discomfort in typical farm houses and to develop ways of improving these conditions.[11] Observations in occupied farmhouses near Athens have revealed some interesting information. For example in Fig. 1 is shown three temperature curves recorded during the week of January 17-23, 1938. Curve *A* shows the temperature recorded in the kitchen of a house which might be termed average farmhouse construction for this particular section. The room had an 8-ft ceiling height and the thermograph was located 6 ft above the floor. Curve *B* is a curve which was obtained in the kitchen of a house representing better than average farmhouse construction. The ceiling height was 8 ft, and the thermograph located 52 in. above the floor. Curve *C* indicates outside temperatures during this period. The kitchens were compar-

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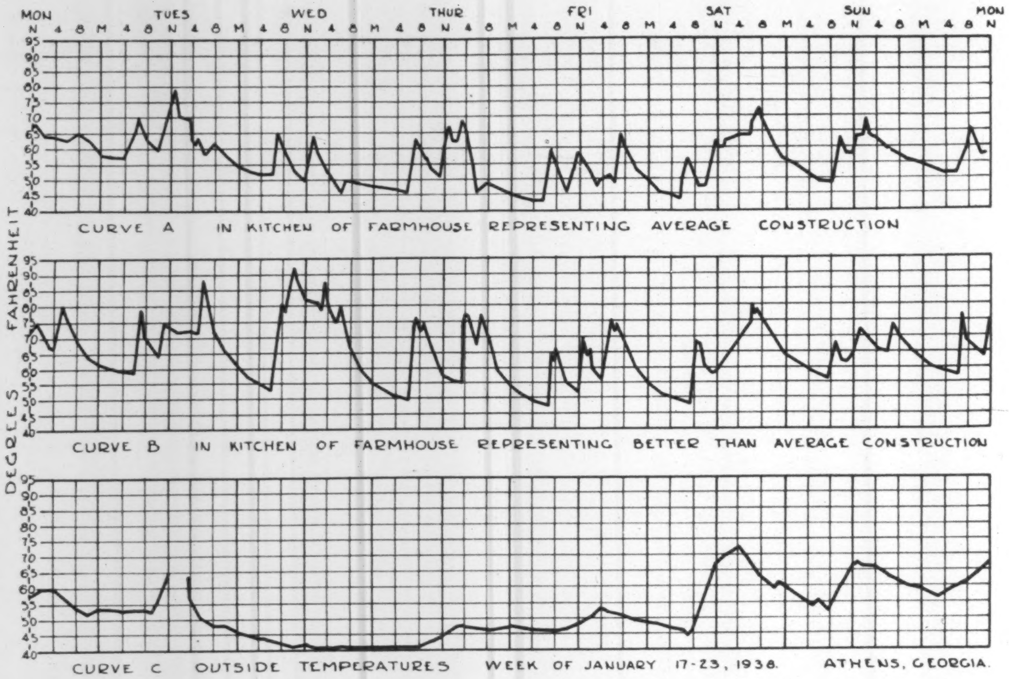
*Research Agricultural Engineer, University of Georgia.
Presented at the Fall Meeting of the American Society of Heating and Ventilating Engineers, Atlanta, Ga., October 1939.



Other typical problems being investigated include, (1) effect of door and window placement on natural ventilation, (2) comparison of ceiling heights from the standpoint of comfort, (3) attic cooling, (4) effect of vines and foliage on wall surface temperatures and, (5) the advantages of a continuous foundation over conventional piers. Although the farm home is a small unit, a great number of them exist and that they be comfortable is a requirement which cannot be overlooked if the standard of living of the people (in Georgia the great majority of people) is to be satisfactory.

Fig. 1—Temperatures recorded in Georgia farmhouses during the week of January 17-23, 1938. Curve A was obtained in the kitchen of a house representing average construction; curve B was obtained in the kitchen of a house representing better than average construction; and curve C represents the outside temperatures for this period

able in size, and the temperatures recorded an equal distance horizontally from the cooking stove. In the living rooms the temperature fluctuations would have been less with the minimums being about the same and the maximum temperature peaks considerably reduced. The great majority of the bedrooms are unheated, but in most cases are equipped with grates. In commenting upon the projects at Madison and Athens, one investigator[11] commented that a surprising fact was that the air temperatures in the southern houses were considerably below those found in the Wisconsin homes. Although many farm families say that their houses are comfortable, recorded temperatures in them would indicate that such a statement is made only in view of an ignorance of what constitutes satisfactory heating.

At present the spendable income per farm family in the south is deplorably low. However, it is safe to predict that slow increases will be made with the adoption of better agricultural practices and techniques. Farmers are asking and will continue to inquire in even greater numbers than at present concerning better building materials including insulation, ventilation and proper design to afford maximum comfort. Through the farm housing research study at Athens it is hoped that some of these questions will be answered through the application of sound research methods. For example, work has been conducted on cottonseed hulls as an insulating material inasmuch as they are cheap and available on many southern farms. They have been found somewhat less effective than an equal thickness of commercial insulation, but are, nevertheless, satisfactory. A simple and inexpensive process for treating hulls with ammonium sulphate has been devised making them fire resistant. If the treating is done by the farmer the cost of material is about 1/3 that of first grade commercial insulation. However, if the labor for treating must be hired there would be little or no saving.[11]

Sweet Potato Curing and Storing

In recent years southern agriculturists have manifested an interest in growing sweet potatoes primarily as a food for human and livestock consumption, but also in the production of raw starches. With this development comes the problem of curing and storing the potatoes satisfactorily. The main cause of damage in the potatoes during the curing and storage period results from an uneven distribution of heat which may be caused either by the type or location of the heating equipment or a lack of ventilation to insure the removal of the moisture laden air from the curing room.[8] Studies being conducted at several southern agricultural experiment stations are investigating this problem.

Seven requirements have been cited for the successful storage of sweet potatoes.[13] They are as follows:

1. The storage house must be clean and sanitary.
2. The crop must be harvested before it is injured by low temperature in the fall.
3. Particular care must be taken to avoid cutting and bruising or otherwise injuring the sweet potatoes during digging, picking up, grading, placing in containers and moving to the storage house.
4. Injured roots, or roots showing evidence of disease must be carefully excluded from storage.
5. The sweet potatoes must be thoroughly cured immediately after being put into the house.
6. The proper storage temperature must be maintained after curing.
7. The hazards of spreading disease in the house must be avoided by leaving the sweet potatoes undisturbed until they are removed from the house. . .

Requirements 4, 5 and 6 are of the most interest to engineers. The skin of the sweet potato is thin, delicate and easily broken. Despite the utmost care in harvesting it is known that two broken places must of necessity appear on the root, on the ends broken in harvesting.

The U. S. Department of Agriculture[13] has shown that this injury and those of like nature can be rendered less harmful to the potatoes in storage by the formation of wound cork, which is in reality simply the formation of new cells.

Wound cork is formed only under certain conditions of temperature and humidity, and it is apparent that the curing room must furnish these. The formation is promoted most rapidly at a temperature of 89 F, and a relative humidity of 92 per cent, although the long accepted temperature of the curing room at 85 F and a relative humidity of 85 per cent is satisfactory for this healing. If the temperature is held between these figures of 85 and 89 F and the relative humidity allowed to drop to 65 per cent wound cork fails to form and the crop will be lost.[13]

Although it is permissible to allow the potatoes to weather for an hour after digging, the roots should enter the house promptly and under proper temperature and humidity conditions. Rapid removal of the moisture from the freshly dug potatoes is essential. It may be thought that the thorough ventilation of the house will result in a too low relative humidity, but this need not be feared in that the moisture given out by the roots will keep the air immediately surrounding them moist, particularly if the potatoes are stored in packages or bins. The usual difficulty is to provide sufficient ventilation to eliminate the condensation of moisture on the sweet potatoes and the walls of the house. The duration of the curing period cannot be stated definitely but in most cases extends from 10 to 15 days.

The healing of wounds is but one of the several important changes that takes place in the sweet potato during curing. The root is about 68 per cent water and about 10 to 15 per cent of this is removed.[12] Some solid substances are also lost as a result of respiration. A surprising fact is that despite an 8 to 10 per cent reduction in weight during the curing period the proportion of dry matter to water content remains very near the original figure.

After curing the potatoes can be kept almost indefinitely at a temperature of 50 to 55 F and a relative humidity of 75 to 85 per cent. Chilling of the potatoes results very quickly in rot, internal discoloration of the root and the failure of the potato to produce sprouts when bedded.[13].

The utilization of flue heated tobacco barns for sweet potato storage houses is a subject in which much interest has been manifested during recent years. Such a house is shown in Fig. 2.[2] Since uniformly distributed heat is essential in both the curing and storage process the conventional barn furnace and flue is conducive to a far better condition than is a stove located either above or below the floor of the storage house. This finding is significant in that the sweet potato and tobacco belts are to a large extent synonymous, the two crops maturing at different times, thus allowing the tobacco barn furnace to be utilized for two different purposes and in the production of two cash crops.

Fig. 2 indicates no window area although at present 1 sq ft of door and window area per 13 to 16 sq ft of wall area is usually incorporated into designs for storage houses. Ventilators will vary greatly in size, but are usually 12 x 12, 16 x 16, 10 x 12, 12 x 18, or 18 x 20 in. Considering both inlet and outlet ventilators a total of 5 to 8 sq in. of ventilator cross-section is allowed per square foot of floor area. It is known that adequate ventilation is of vital importance in successful sweet potato storage, but exact design figures are not available.

Table 1—Curing and Storing House of Mr. Fred Wilson, Warsaw, Ga.

(Season of 1938-39)

Capacity of house	1000 Bushels
Bushels of potatoes cured and stored	1000 Bushels
Dimension of house	20 x 18 x 10 Ft
Capacity	3600 Cu Ft
Electrical capacity installed	7 kw
Electrical capacity per 100 bushels	0.7 kw
Electrical capacity per cu ft of space	2 w
Time required for curing potatoes	18 Days
Temperature required for curing	85 F
Temperature required for storing	55 F
Kwhr consumption October to April	2,674 kwhr
Actual current cost	$85.80
Cost per bushel to cure and store	0.0858
Kwhr per bushel to cure and store	2.67 kwhr
Estimated—75 per cent to cure 18 days at 85 F	
—25 per cent to store 5 months at 55 F	
Cost of house[a]	200.00
Cost of electrical equipment	50.00
Cost of wiring	50.00
Miscellaneous items	10.00
Total cost of house	$310.00

[a] Farm labor was used in constructing the house. A portion of the lumber was cut and sawed on the farm.

Heating such a house as is shown in Fig. 2 electrically, has been and is the subject for much investigational work. Strip heaters of 500 to 1000 w (*watt*) capacity are used and good results have been reported. Data taken from an installation at Warsaw, Ga.,[5] are shown in Table 1.

Dairy Production

Agricultural leaders in the south have for the past few years advocated the production of livestock in an effort to supplement or completely replace the one crop system of cotton farming which has been so detrimental to this particular section. The portion of this program which has advanced most rapidly has been that of dairying.

For high production the dairy cow is a highly bred animal. She lacks the protective coating of fat which characterizes beef cattle and is extremely sensitive to environmental conditions. Some may believe that the southern climate is sufficiently mild to make the housing problem simple, but leading dairymen in many parts of this section are prone to disagree with this suggestion. A close relation exists between the amount of feed consumed and the temperature of the air maintained in the stable.

Heat losses in dairy barns are calculated by the conventional method of taking into consideration the following factors:

1. Losses through wall, ceiling, floor, window and door areas.
2. Infiltration and exfiltration losses.
3. Heat losses through ventilation.

To compensate for these losses the heating source must necessarily be in practically all cases the body of the cow which maintains itself at 101.5 F. A few figures used in design are given in Table 2.[16]

The proper ventilation of the barn is of extreme importance. Moisture production per unit is 12 to 18 lb per day or an average of 4375 gr (grains) per hour. The amount of air provided in the majority of satisfactory systems in the south is about 59 cu ft per minute per cow whereas the amount breathed per unit is approximately 1.9 cu ft per minute.[4]

In January with an average outside relative humidity of 85 per cent, 4375 gr of moisture must be removed

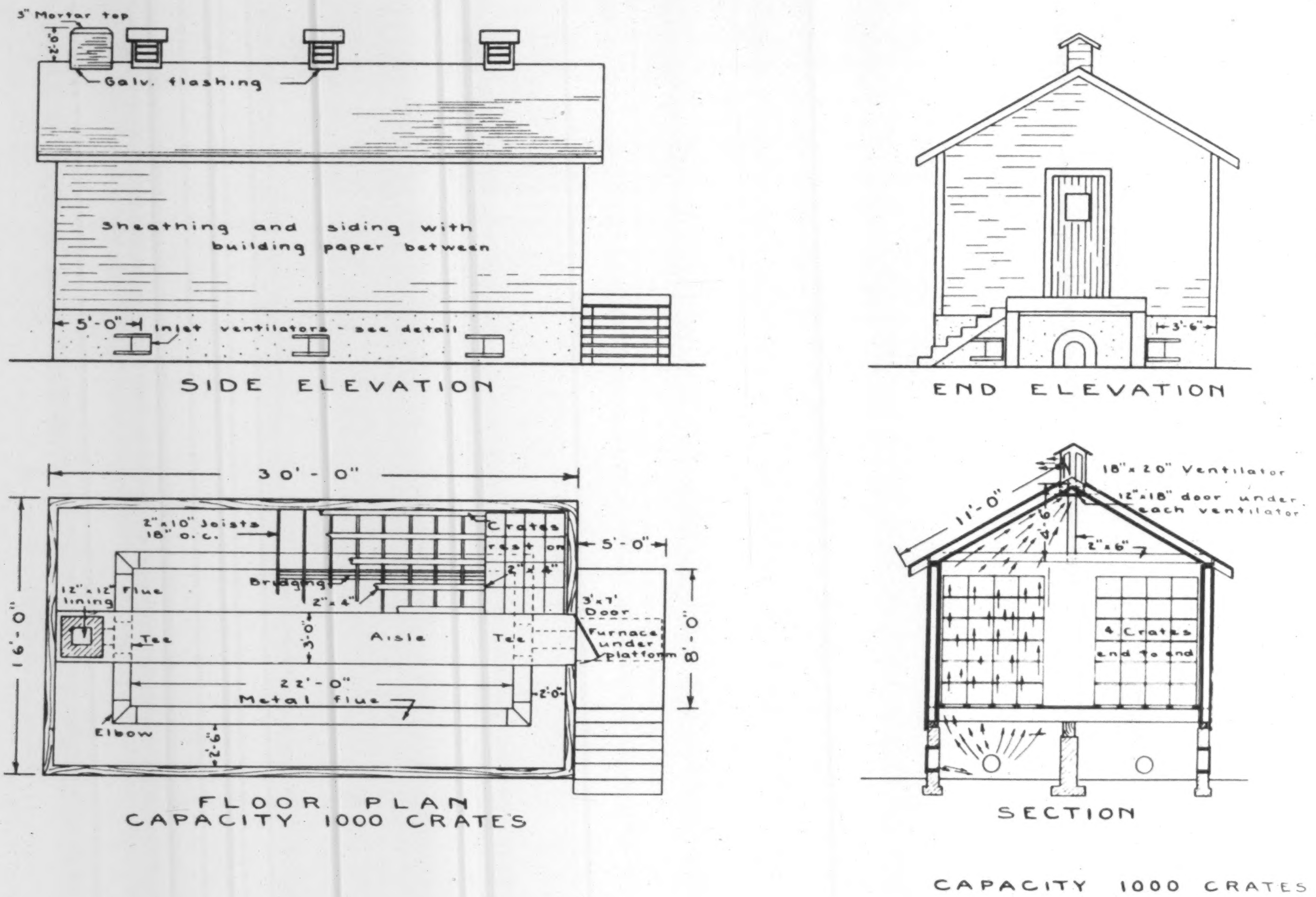

5" Mortar top
2'-6"
Galv. flashing
Sheathing and siding with building paper between
5'-0"
Inlet ventilators - see detail
SIDE ELEVATION
3'-6"
END ELEVATION
30'-0"
16'-0"
2"x10" Joists 18" o.c.
Crates rest on
5'-0"
Bridging
2"x4"
2"x4"
12"x12" Flue lining
3'x7' Door
Tee
3'-0"
Aisle
Tee
Furnace under platform
8'-0"
22'-0"
Metal flue
2'-0"
Elbow
2'-6"
FLOOR PLAN
CAPACITY 1000 CRATES
18"x20" Ventilator
12"x18" door under each ventilator
11'-0"
6'-0"
2"x6"
4 Crates end to end
SECTION
CAPACITY 1000 CRATES

Fig. 2—A furnace heated tobacco barn can be utilized for a sweet potato curing and storing house

hourly per unit so as to prevent an increase in the degree of saturation in the stable. At a stable temperature of 45 F the humidity should not exceed 85 per cent and this percentage or less may be maintained with good ventilation. At a stable temperature of 53 F a relative humidity of 75 per cent is obtainable in ordinary good practice. These limiting values are used in comparing the several standards with proportional values for the intermediate points.

By basing calculations upon these limits it is found to remove 4375 gr per hour there would be required approximately 1800 cu ft of air per hour with the air entering at 0 F, and a normal degree of saturation whereas at 32 F outside temperature a little more than 2700 cu ft would be required. In the south with comparatively high winter temperatures and correspondingly high winter humidities the amount of ventilation would be increased.[6]

In calculating the size of flues it immediately becomes apparent that no one size will meet the requirements of all outside weather conditions. The following formula is often used in calculating flue sizes per animal.[6]

Table 2—Heat Production of Cows

Description of Animal	Btu/Hour
Jersey cow producing 20 lb of milk per day	2700
Jersey cow producing 30 lb of milk per day	3000
Average farm cow	3000
Holstein cow producing 30 lb of milk per day	3300
Holstein cow producing 45 lb of milk per day	3400

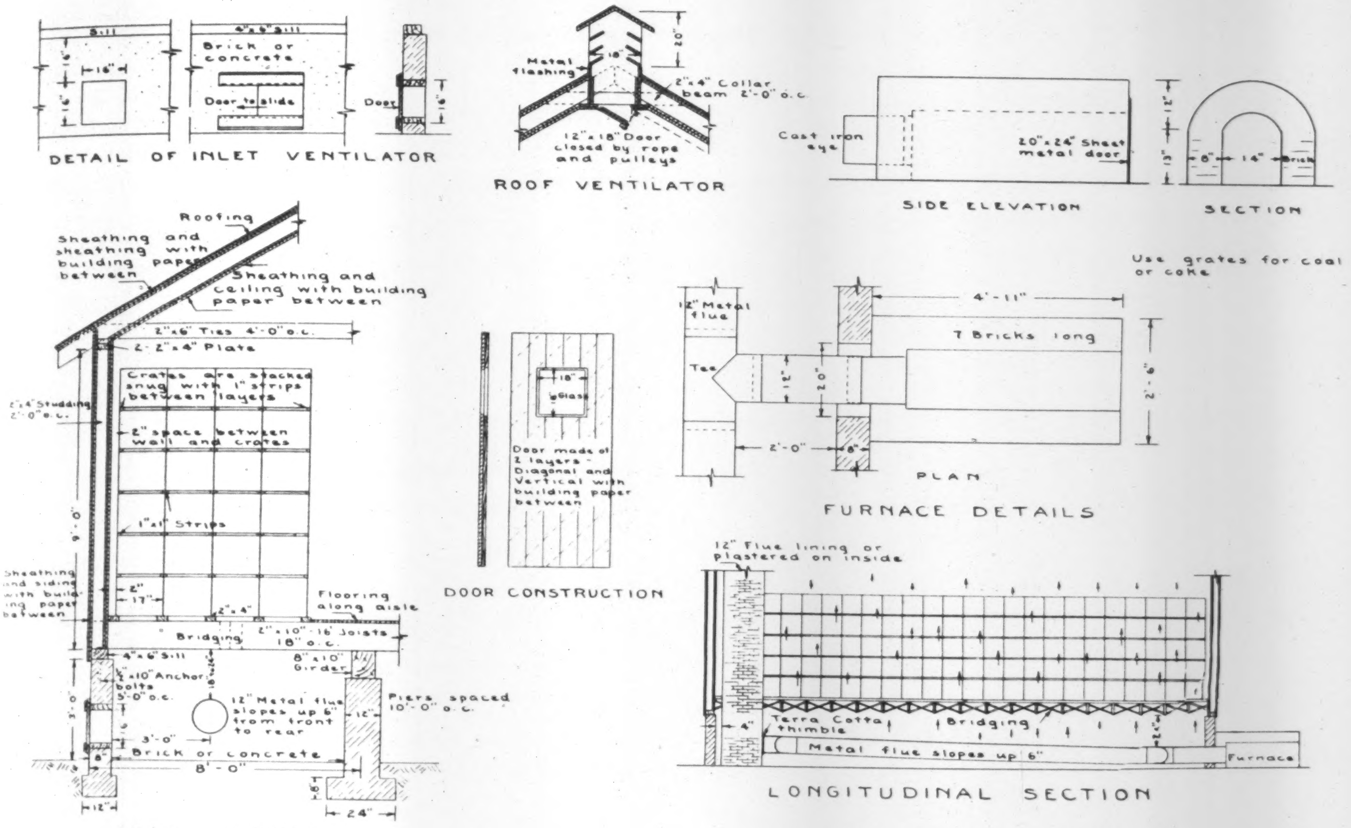
$$A = \frac{163 + 1.6(t_o)}{\sqrt{H}}$$

A = area of flue in square inches per animal
t_o = mean January temperature degree Fahrenheit
H = height of flue in feet

The use of this relation usually results in a flue area of from 35 to 42 sq in. per unit housed considering mean January temperatures in southern areas where the climate is sufficiently severe to warrant ventilation.

Recent investigational work has revealed that the dairy cow thrives best in a temperature of about 50 F when in stanchions and on moderate feed. Additional published facts[7] include:

1. Production of milk was above average but butterfat was below the average at 60 to 65 F. At the warmer temperatures cowpox was more prevalent and cows seemed less comfortable than at lower temperatures.
2. There is a direct relationship between excessive drafts and pneumonia. Risk of sickness appears to increase with the degree of exposure to draft.
3. Under ordinary good conditions of milk production artificial heat in stables is undesirable.
4. The decline in milk yield was faster in the stable where inside temperatures fluctuated with weather than in those where temperatures were held nearly constant. Cows in the open pen fell off sharply in production during cold periods but with the return of mild weather recovered more quickly than the cows in the stanchions.


Sill
4"x6" Sill
Brick or concrete
16"
Door to slide
Door
DETAIL OF INLET VENTILATOR
Metal flashing
18"
20"
2"x4" Collar beam 2'-0" o.c.
12"x18" Door closed by rope and pulleys
ROOF VENTILATOR
Cast iron eye
20"x24" Sheet metal door
SIDE ELEVATION
8"
14"
Brick
SECTION
Use grates for coal or coke
Roofing
Sheathing and sheathing with building paper between
Sheathing and ceiling with building paper between
2"x6" Ties 4'-0" o.c.
2-2"x4" Plate
Crates are stacked snug with 1" strips between layers
2"x4" Studding 2'-0" o.c.
2" space between wall and crates
1"x1" Strips
9'-0"
Sheathing and siding with building paper between
2"
17"
2"x4"
Flooring along aisle
Bridging
2"x10"-16' Joists 18" o.c.
4"x6" Sill
8"x10" Girder
½"x10" Anchor bolts 5'-0" o.c.
12" Metal flue slopes up 6" from front to rear
Piers spaced 10'-0" o.c.
12"
3'-0"
Brick or concrete
8'-0"
12"
24"
WALL DETAIL
18"
Glass
Door made of 2 layers - Diagonal and Vertical with building paper between
DOOR CONSTRUCTION
12" Metal flue
Tee
12"
20"
4'-11"
7 Bricks long
2'-6"
2'-0"
8"
PLAN
FURNACE DETAILS
12" Flue lining or plastered on inside
Terra Cotta thimble
Bridging
4"
Metal flue slopes up 6"
Furnace
LONGITUDINAL SECTION

Air enters inlet ventilators - is heated - rises through potatoes - exits through roof ventilators

Fig. 2 (Cont'd)—A furnace heated tobacco barn can be utilized for a sweet potato curing and storing house

Hay Production

Closely associated with the expansion of the livestock industry in the south is the production of an abundant supply of feed. In this connection hay is perhaps the most important crop. Georgia produces a comparatively large acreage, but the quality is not high and the feeding value and market price are consequently low. The chief contributing factor to this unfavorable condition is adverse weather at the time of cutting and harvesting the hay. To emphasize the importance of quality hay average price differentials can be quoted for the period of July 1, 1930 to June 30, 1935, at Kansas City, Mo.[10] U. S. No. 1 alfalfa was $2.55 above the price for U. S. No. 2 alfalfa and the price for the latter averaged $2.50 above the price for U. S. No. 3 alfalfa. Alfalfa hay of the very leafy, clinging foliage type, which is graded under United States standards as U. S. No. 1 extra leafy, or U. S. No. 2 extra leafy alfalfa, sold at premiums of $2.00 to $7.50 per ton above the prices paid for straight U. S. No. 1 alfalfa. Nor is the difference in price the only advantage of the higher grades. Feeding specialists state that the added feeding value of the higher grades far outweighs the price difference.

Several investigations are in progress in the southern states involving the artificial drying of the hay by means of passing through it unheated atmospheric air. Such a project is located at the College of Agriculture, University of Georgia, Athens, and is briefly described.

The system is installed in the north end of the dairy barn which is 37 x 43 ft in size. The opposite end of the mow is utilized for hay dried by the conventional field method. A blower furnishes approximately 12,000 cu ft of air per minute for the system at about 0.6 inch static pressure. The blower consists of two multivane blowers, each having a 22-inch square discharge and mounted on one shaft. A 5-hp repulsion-induction electric motor powers the blower.

The distributing system consists of a delivery duct which brings the air from the blower location which is near the ceiling of the first floor to the main duct which runs lengthwise along the floor of the mow. The main duct varies in size to facilitate more uniform air velocities. Branching perpendicularly from the main are lateral ducts spaced approximately 5 ft on centers and which extend to within about 4½ ft of the barn walls.

Despite high humidities promising results have been obtained in drying the hay to a maximum depth of 10 ft. Power requirements will fluctuate greatly in accordance with the original moisture of the hay, weather conditions, type and maturity of the grass and other factors. However, at Athens the kilowatt-hour consumption has varied from 20 to 40 per ton of hay dried.

The scheme allows the hay to be cut in the morning after the dew is gone, passed through a wilt period and placed in the barn late in the afternoon at a moisture as high as 55 per cent. Drying is continued until an average mow moisture of 20 per cent is reached. Preliminary results indicate an increase of one grade and class for the barn dried hay over the conventional field dried product. Such a system saves the leaves on the plant wherein the great proportion of the feeding value lies, results in a greener color or a higher carotene content indicative of vitamin content and largely eliminates the hazard of unfavorable weather conditions. This is a spendid example of utilizing ventilating principles toward the solution of an agricultural problem.

Freezer Locker Systems for the Farm

The desirability of fresh fruits and vegetables over the conventionally preserved products has long been recognized. Being available only for short periods low prices, unorderly markets and general dissatisfaction among the growers have not been uncommon. Likewise the consumer has shown such a marked preference for the fresh product that the producer would often attempt to prolong the season by offering inferior products for sale.

In all sections of the country other than the south it is not unusual to bring fruits and vegetables from the fields in the prime of their goodness, put them through a process depending upon their nature and preserve them by freezing until they are needed for family consumption or the market is right for their disposal.

Although largely commercialized in the east freezer-locker units are still essentially a farm enterprise in the west and far west. Farmers combine to form a cooperative with the size of the plants varying from 20 to 50 lockers operated in conjunction with the general store to complete units of 500 to 2000 lockers. The following units are usually found in the medium-sized plant: (1) receiving room, (2) processing room, (3) chill room, (4) quick freeze room and (5) storage-locker room. Other facilities provided by some plants are butchering service, either on the farm, at the plant, or both, smoke rooms, salt rooms, the purchase of products from farmers, egg processing and the wholesale and retail sale of frozen fruits, vegetables and meats. Lockers are most commonly rented by the year to members of the cooperative although some plants charge a certain price per pound for the materials processed.[9]

Pork and beef carcasses are placed in the chill room maintained at about 32 to 36 F to remove the animal heat and age properly before being moved to the processing room to be cut into usable pieces. Pork is aged 2 to 3 days, lean beef 3 days to a week, well covered beef 3 to 4 weeks and poultry 12 to 24 hours. From the processing room the products go to a quick freeze room kept at about —10 F where meats are held 8 to 12 hours until frozen solidly. Finally the cuts enter the storage-locker room which is usually held at 5 to 12 F and kept for final disposal.[3]

Fruits and vegetables are processed, quick frozen and stored in the storage-locker room. The processing of these products although in the majority of cases very simple, vary widely. As in all refrigeration the proper control of temperature, humidity, air motion and air purity is vital.

The method of food preservation makes it possible for farm food surpluses to be cared for in a most satisfactory manner. It is believed that freezer lockers will bring to the farm people of the south a higher standard of living as a result of more nutritious and varied diets. Further, its development will be an incentive toward livestock production, poultry enterprises, truck farming and in general a more diversified agriculture.

It has been attempted to stress the fact that there are definite farm problems involving the principles of the profession. The topics which could have been touched are practically inexhaustible, such as artificial drying of agricultural products other than hay, the several branches of food processing on the farm, electric ventilation of dairy barns, air conditioning of seed storages, heating, ventilating and air conditioning requirements of the poultry plant taking into consideration hatcheries, brooder houses, laying houses and egg storages, solar heating systems and many others. However, if there has been a diversion for an instant from the large commercial and urban developments to engineering as it may be applied to the most basic of all arts and sciences, that of agriculture, the mission has been fulfilled.

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Food Preservation in the South

By C. T. Baker* (*MEMBER*), Atlanta, Ga.

THE purpose of this paper is to outline the methods employed in preserving food commodities in the South and to indicate the possibilities for further development in this field by the application of modern refrigeration to food conservation.

It is well known that impairment in the quality of foodstuffs, such as vegetables, fruits and certain other commodities, will occur quickly unless they are placed either in cold storage or are processed in some manner immediately after harvesting.

Methods employed in the South for food preservation do not differ greatly from those common to other sections of the country. However, the climatic conditions in the South are different from those of other sections, as is also, to some extent, the character of the food commodities grown. Because of this, somewhat different methods are employed in the growing, harvesting and conserving of foods.

Methods Employed

In general three methods are employed in food preservation in the South; they are as follows:

(a) Canning
(b) Freezing, and
(c) Storage under controlled refrigeration for periods of from one to six months, depending largely upon the market conditions.

Each of the three methods is satisfactory as a means of food preservation for southern-grown foods just as they are and quite common to other sections. There is, however, a decided trend toward processing by freezing in the South and therefore this method of food preservation will be more fully treated here than preservation by the orthodox method of cold storage.

Many kinds and varieties of southern grown foods may be successfully frozen. One of the principal reasons for preserving foods by freezing is to insure the preservation of their natural, or fresh, qualities such as appearance of color, taste, aroma and, to a considerable extent, texture.

Preservation of Peaches by Freezing

In Georgia and in the Carolinas considerable volumes of peaches are frozen during the gathering season, stored at low temperatures, and later sold to the trade. Some of this freezing is done in bulk and some in small containers, depending upon the particular market to which supplied. Bulk frozen peaches are used by both the ice cream and the baking industries, while the small-package frozen product is disposed of largely for table consumption in hotels, restaurants and homes. To a limited extent, peach juice is frozen to be later used in the production of peach wine. Georgia peaches for the latter market were first quick-frozen during the peach season of 1930. The method of freezing employed was the dry, cold-air blast system. Two such installations were made in the State, one of which is still in operation.

With time, other and more improved methods of peach freezing have been developed that are free from the short comings common to the cold-air freezing system, as used in these two early developments, with the result that these newer and better methods have greatly accelerated peach processing by freezing.

These improved methods of freezing consist of immersing metal containers of prepared peaches in low-temperature brine solutions, or by immersing the product in low-temperature syrup.

Because of the rapidly increasing public acceptance of this commodity in frozen form, not only in the South but in the North and East as well, the peach grower is assured of a market for that portion of his product which cannot be disposed of as fresh peaches and which otherwise would represent a loss.

The experience of years has shown that it is seldom possible to profitably dispose of the entire peach crops of Georgia and the Carolinas as fresh commodity with the result that monetary losses to the grower have been considerable, particularly during the years of bumper crops.

The economic advantages of freezing of foodstuffs in the South are not limited to peaches, but apply equally to a wide variety of other fruits and vegetables, such for example as southern grown strawberries, raspberries, figs, spinach, asparagus, peas, beans, etc.

Type of Refrigerating Equipment Employed

The engineer is perhaps as much interested in the application of refrigeration to these processes as he is in the procedure itself. Therefore, the description of the system used in a plant designed for the quick freezing of lima beans is included from a previous paper by the author.[1]

> The room in which the freezing is performed and in which are located the low temperature cooling coils and air circulating fan, is approximately 28 ft 6 in. long by 22 ft wide and 8 ft high in the clear. Adjacent to the freezing room is a refrigerated ante-room which also serves as a work room and is carried at a temperature of 40 F. The refrigerant vapors from the low temperature evaporating coils are handled by a booster compressor, 7¾ bore by 5 in. stroke, that discharges into the main suction header of the two compressors operating on the ice-making tank, the gas passing first through a gas cooler where the superheat is removed. Under maximum load conditions this booster compressor operates at a suction temperature of —45 F and against a discharge pressure corresponding to the suction pressure resulting from the ice tank operation, 22 to 24 lb gage.
>
> The starting and stopping of the booster compressor is controlled automatically by a thermostat set to stop the machine when the freezer room reaches a temperature of —30 F and to start it again when the room temperature has risen to —26 F. In order to provide the required air circulation in the freezing room and over the evaporating coils, a motor-driven fan is used which has a capacity of approximately 17,000 cu ft of free air per minute.

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*Consulting Engineer.
Presented at the Fall Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Atlanta, Ga., October 1939.

[1] What Is Ahead for the Foreign Food Industry in the Southeast, presented at the Food Preservation Conference, University of Tennessee, October, 1938.

This layout was designed to take care of the quick freezing of 10,000 lb of lima beans per day of 24 hours in an air temperature of —30 F. The cooling load of the beans was based on the following physical data:

Specific heat above freezing	0.92
Latent heat per pound Btu	128.
Specific heat below freezing	0.47
Freezing point, degrees Fahrenheit	30.
Water content, per cent	89.
Solid content, per cent	11.

Previous to the quick freezing of a part of this lima bean crop, the beans were processed by canning, which was done for the first time this summer.

The operation of the plant just described has been extended to include Georgia peas which it is found may also be successfully processed by quick freezing, while at the same time they insure to the consumer the advantages of the quality and natural properties of fresh grown commodities.

Reasons for Compound Compression

The reasons for using the booster-type compressor in the installation described previously were two-fold; first it enabled the plant owner to make use of reserve compressor capacity already installed thus keeping his investment in new equipment low, and second, to insure low power consumption per ton of refrigeration.

Combination of Ammonia and Carbon Dioxide to Produce Low Temperatures

In two southern quick freezing plants using low-temperature air as the carrying medium for removing heat from the commodity to be frozen, the air was cooled by means of a low-temperature evaporator using CO_2 as the refrigerant.

A CO_2 compressor handles the low-temperature gas from the evaporator in the freezing room and discharges it to a condenser which employs ammonia as the condensing medium, rather than water as is commonly used in CO_2 practice.

The evaporating pressure on the ammonia side of the condenser is maintained at from 15 to 20 lb square inch gage, while the CO_2 condensing pressure will vary from 350 to 400 lb square inch gage, with a suction inlet pressure at the CO_2 compressor of from 75 to 100 lb square inch gage, depending upon the requirements. In one case, the CO_2 compressor and the ammonia compressor were directly connected to a synchronous motor, centrally placed between the two compressors.

In addition to handling the CO_2 condensing requirements of this plant the ammonia compressor also maintained the required temperatures in the rooms where the quick-frozen commodities were stored. In the second plant, which was somewhat smaller but which employed the dual-compressor system, both the ammonia and CO_2 compressors were driven by independent motors.

These two installations, which were made several years ago, operated satisfactorily but did not permit the same economy in the use of power as did the compound-compression plants using ammonia as the refrigerant. Large tonnages of various kinds of sea foods, including shrimp, are caught annually in southern waters. Freezing is one of the best methods of preserving these foods, and there are many fish and shrimp freezing plants already in operation in several southern states in which the fishing industry has attained sizable proportions.

Since fish is a food which is an easy prey for destructive organisms, it is quite important that such sea foods be processed as quickly as possible after catching. This is one of the reasons for the wide development of fish freezing plants in the south.

Storage of Pecans

A large number of pecans are grown in certain of the southern states, notably Georgia. In recent years, cold storage facilities have been developed to protect this commodity against the shortcomings of the non-refrigerated storage. The refrigerated storage when held at the required temperatures and humidity will prevent the drying out of the nuts and the rancid condition resulting from dehydration such as occurs in the ordinary storage house not having the benefit of refrigeration.

A three-story pecan storage plant, designed by the author a few years ago, made use of the unit coolers rather than the generally accepted method of cooling by means of coil evaporators. Two such coolers were used in each of the three floors; they were arranged for flooded operation with each room provided with a magnetically-operated liquid valve that was opened and closed by means of a thermostat in accordance with the predetermined or required temperature range.

This method of cooling pecan storage rooms has been found by the writer to be entirely satisfactory and maintains the temperature and humidity conditions without difficulty. The required conditions of temperature and humidity were met by selecting unit coolers of ample capacity to handle the heat load without wide ranges of air temperatures between the air inlets and outlets.

A constant evaporating pressure, and therefore a constant evaporating temperature, is maintained in each of the floor type unit coolers installed by means of a sensitive back-pressure valve located at the suction outlet of each cooler and in this case the evaporating temperature was held constant at 18.5 F.

The fan capacity of each unit was sufficient to do the work at a temperature range between the air entering and leaving the cooler of not over 15.5 F. The average temperature maintained in these rooms is 35 F with an average relative humidity of 90 per cent.

Method of Handling

The pecans begin moving into storage early in November and continue coming in until about March 1, although it is preferred, in the interest of proper holding, that the receiving time extend not beyond February 1, since the nuts become rancid if held too long in dry storage.

Approximately 90 per cent of the pecans stored in this plant are in the shell and are held in burlap bags. The balance is shelled and placed in airtight cartons or boxes of from 1 to 5 lb.

As a result of the development of the modern pecan storage in which both temperature and humidity are controlled within very close limits, losses incident to spoilage have been almost entirely eliminated, while at the same time, the average price per pound to the grower and storage operator has been increased.

The Locker Storage

The locker storage, a comparatively new development in the field of food preservation, is *moving in* from north of the Mason and Dixon line and appears destined to play a leading role in the practice of food preservation in the South. The modern locker storage development includes facilities for low-temperature freezing and storage and the refrigerating plants required for such installations may be and generally are fully automatic.

The usual locker development calls for a receiving room, chill room, processing and wrapping room, freezing and locker room and usually a customers lobby.

Conclusion

In conclusion, it may be stated that the South will continue to make use of refrigeration in every practical and proven manner to the end that food processing by freezing and food preservation by storage will play a large role in every community, and thus insure to grower and to consumer alike the benefits of modern processes that are made possible by the art and science of refrigeration.

Oregon Engineers Receive Charter

A charter was formally presented to the newly organized Oregon Chapter of the Society at a banquet on October 5, in the Marine Room of the Multnomah Hotel, Portland, Ore. E. O. Eastwood, professor of mechanical engineering, University of Washington, and a member of the Society's Council, represented Pres. J. F. McIntire and made the presentation on behalf of the Council. J. Donald Kroeker, president of the Oregon Chapter, in accepting the charter in behalf of the Chapter, traced the development of interest and membership in the Society in Oregon, and introduced the nucleus of 8 members from which membership has grown to its present status in 1939. The new chapter is the Society's 28th since it was founded in 1895 for the advancement of heating, ventilating and air conditioning.

The chapter was welcomed by City Commissioners Earl Riley and W. A. Bowes, and by delegates from other chapters on the Pacific coast. R. O. Wesley, president of the Pacific Northwest Chapter, and 17 members of that chapter were in attendance.

The toastmaster, Bert W. Farnes, opened the meeting with the reading of "The American's Creed," an appropriately framed illuminated engraving presented by the Washington, D. C., Chapter of the Society with greetings for the occasion.

C. F. Walker, president, Northwestern School of Commerce, as speaker of the evening, presented an inspiring and practical address on Enduring Values, stressing the fundamentals of truth and honesty and predicted that success of the new chapter would be determined by the extent which the spirit of *give* overshadows the spirit of *take*.

Telegrams of greetings and wishes of success were received from President McIntire and Secretary A. V. Hutchinson, members of the Council, Charles A. Sprague, governor of the state of Oregon, as well as from 16 other chapters, each containing an appropriate sentiment for the occasion.

Also at the banquet were delegates from various professional groups, *American Society of Mechanical Engineers, American Institute of Architects,* Oregon Technical Council, *American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society for Metals, American Institute of Electrical Engineers,* and the Professional Engineers of Oregon. Other groups represented were the Oregon Building Congress, *Heating, Piping and Air Conditioning Contractors' National Association,* Oregon State Plumbers, and *Portland Warm Air Heating Association.*

Lehigh Air Conditioning Conference

The Eastern Air Conditioning Conference, held at Lehigh University, Bethlehem, Pa., November 10-11, attracted 150 visitors for the three technical sessions which were held in Packard Laboratory. The first session was devoted to comfort air conditioning, and the chairman was A. R. Stevenson, Jr., Schenectady, N. Y., past president of the *American Society of Refrigerating Engineers.* A brief word of greeting was given by Walter Okeson, trustee of Lehigh University, and then three papers were presented by the authors: Refrigeration Storage for Handling Peak Loads by Carl F. Boester, St. Louis; Hotel Guest Room Air Conditioning Practices by John R. Hertzler, York, Pa.; and Analysis of Air Conditioning for an Educational Building by S. R. Lewis, Chicago, Ill.

A group luncheon was served after which the second session devoted to human responses to comfort air conditioning was conducted by Prof. F. E. Giesecke, College Station, Tex., first vice-president of the ASHVE. The three papers presented by the authors were: Air as a Vehicle of Contagion by Dr. W. F. Wells, Philadelphia, Pa.; A Realistic Approach to Hospital Air Conditioning by C. F. Neergaard, New York, N. Y.; and The Uses of Air Conditioning in Hospitals by Dr. M. B. Ferderber, Pittsburgh, Pa.

At the conclusion of the afternoon session there was an inspection of the University's Laboratories and many of the visitors were particularly interested in the set-up of round and square ducts, in which air friction, air delivery and other essential characteristics of duct performance are being studied under a cooperative agreement sponsored by the ASHVE.

Promptly at 7:00 p.m. those attending the Conference gathered at the Hotel Bethlehem for a banquet arranged by the Philadelphia Chapters of the *ASRE* and ASHVE, and Mr. Stevenson acted as toastmaster and introduced officers of the various sponsoring organizations and the committees in charge of the Conference.

C. C. Williams, president of Lehigh University, expressed his pleasure to the committee responsible for the Conference and said that he hoped that future conferences could be held at the University as they were helpful to both the faculty and student body, and created a closer bond between the engineering school and industry.

An illustrated talk was given by Prof. Philip Drinker, Harvard School of Public Health, on the subject of the air we breathe. He covered a wide range in discussing this subject, particularly filtration for the removal of objectionable dusts, treatment for the elimination of odors, fumes and toxic gases.

The subject of industrial air conditioning was discussed at the third session, Saturday morning, November 11, and Dean A. C. Callen presided as chairman. Four papers were presented by the authors on the following subjects: Moisture Removal from Blast Furnace Air by L. L. Lewis, Syracuse, N. Y.; Climate and Air Conditioning by J. C. Albright, New York, N. Y.; Creating a Demand for Air Conditioning by J. L. Rosenmiller, York, Pa.; and The Effect of Modified Atmospheres on Cold Storage by Charles Brooks, Washington, D. C.

The personnel of the Conference Committee was as follows: Prof. B. H. Jennings, chairman; W. A. Bornemann, W. H. Carrier, D. L. Fiske, W. B. Henderson, J. R. Hertzler, A. V. Hutchinson, F. V. Larkin, S. R. Lewis, H. M. Roberts, J. L. Rosenmiller, M. C. Stuart and C. C. Williams.

The sponsoring organizations were *ASRE*, Philadelphia Chapter of the ASHVE and *ACMA*.

THE 1940 NOMINEES—OFFICERS AND COUNCIL

For President—Frederick Ernest Giesecke was born in Washington County, Texas, January 28, 1869. He received his preparatory education in the New Braunfels and San Antonio Schools, and began his professional career at the Agricultural and Mechanical College of Texas, from which he received his M.E. in 1890. In 1904 he received a degree of S.B. from the Massachusetts Institute of Technology, and from 1886 to 1912 he was a teacher at the Texas A. & M. College. As college architect he designed and directed installations of heating systems in new buildings from 1908 to 1912.

He was a student of heating and ventilation under Dr. Rietschel, professor of heating and ventilation at Technische Hochschule, and under Dr. Marx in Berlin, Germany, from 1906 to 1907. In 1913 he became professor of architecture at the University of Texas, Austin, as well as consulting architect, specializing in heating and ventilating. He received a doctor's degree from the University of Illinois in 1924.

Professor Giesecke assumed the duties of Director of the Engineering Experiment Station at the Texas Agricultural and Mechanical College on September 1, 1927 and served in this capacity until his retirement in September 1939, and his new assignment is professor of heating, ventilating and air conditioning at Texas A. & M. He will have charge of the summer short course in air conditioning, will give occasional lectures, and carry on special research relating to the fields of heating, ventilating and air conditioning.

He has been a member of the ASHVE since 1913, and has had a wide experience as engineer and educator, being distinguished for his researches in the fields of hot water heating, heat transmission, and air conditioning for comfort.

Professor Giesecke as well as being nominee for President of the Society is serving as 1st Vice-President, was second vice-president in 1938 and has been a member of the Society's Council since 1932. He is chairman of the Executive Committee of the Council, is serving on Committee on Engineering Scholarships, has served on numerous council and technical committees of the Society, and has presented a great many papers before the Society at its various annual and semi-annual meetings.

He is the author of several technical books including "The Design of Gravity-Circulation Water Heating Systems" published in 1926, and the joint author with A. Mitchell and H. C. Spencer of "Technical Drawing" and "Technical Drawing Problems," and other books.

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For First Vice-President—Walter L. Fleisher was born in Philadelphia, Pa., and attended the William Penn Charter School and the University of Pennsylvania from which he received the degrees of B.S. and M.S., and the honorary degree of M.E. for outstanding achievement in the profession of consulting air conditioning.

From 1903-1911 he was engineer in chief of the New York office of Francis Bros. & Jellett, which specialized in the design of industrial and comfort heating, ventilating, fire protection, power plants, refrigeration and electrical work. In 1911 he formed the W. L. Fleisher & Co., Inc., being president, treasurer and chief engineer of the company. In 1925 this company merged with two other companies under the name of The Cooling and Air Conditioning Corp., of which he became president and chief engineer.

For many years he was chairman of the Standards Committee of the *Heating, Piping and Air Conditioning Contractors' National Association,* and developed the standards for the design of heating systems. He was made honorary member of the Association in 1932.

Mr. Fleisher is also a member of the *ASRE, ASME* and the *American Society of Bakery Engineers.* As a member of the ASHVE he was president of the New York Chapter in 1930-31, and assisted at that time in the design of the ventilation of the Holland Tunnel. Besides being nominee for first vice-president of the Society, Mr. Fleisher is serving on the Executive Committee of the Council, as chairman of the Committee on Research, and for two years was chairman of the GUIDE Publication Committee.

He wrote the chapter on Air Conditioning for the *ASRE* Refrigerating Data Book, and for the *American Society of Bakery Engineers* he wrote most of the early information covering air conditioning and refrigeration and purification in the bakery.

He holds many American and foreign patents covering various phases of air conditioning, drying, refrigeration and cooling. He has written for numerous engineering, chemical and business magazines and other publications on the engineering and economic aspects of air conditioning and also on its potentialities.

Mr. Fleisher, besides being president of the Air & Refrigeration Corp., is consultant for the Abair Corp. of England, the Compagne Abair de France, the Imperial Continental Gas Co., and many other corporations.

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For Second Vice-President—Everett Owen Eastwood was born in Portsmouth, Va., February 5, 1876. He was graduated from the University of Virginia in 1896, receiving degree of C.E. He also received the degrees of A.B. and A.M., from the University. He was graduated from the Massachusetts Institute of Technology in 1902, receiving the degree of B.S. in Naval Architecture. In 1902 and 1903 he was connected with the Bureau of Construction and Repair, Navy Department, Washington, D. C. In 1904 he was employed by the Fore River Shipbuilding Co., and a year later became instructor of naval architecture and mechanical engineering at Lehigh University.

Since 1905 he has been a member of the faculty at the University of Washington; professor of mechanical engineering and head of the department of Mechanical Engineering; consulting engineer for the University, and chairman of the Faculty Committee for preparation of permanent plan for development of the campus, 1913-1915.

During the war Professor Eastwood was in charge of special training courses for Marine Engineers, U. S. Shipping Board, and Naval Ensigns, Naval Recruiting Service, at the University.

He is the author of technical magazine articles and in 1930 was associate editor of Engineering and Finance, as well as consulting and contributing editor of *Heating, Piping and Air Conditioning.* From 1913-1927 he was president of the Board of Trustees, University Congregational Church, Seattle, and from 1913-1929 was chairman of the Board of Directors of the University National Bank of Seattle, and connected with various business enterprises.

He became a member of the Society in 1921 and served on the Nominating Committee representing the Pacific Northwest Chapter from its organization in 1928 to 1931. He was instrumental in organizing the chapter and served as its first president. He is a member of the Society's Executive Committee, the Finance Committee, and on the F. Paul Anderson Award Committee.

Professor Eastwood is also a member of the *ASME,* having served as its vice-president in 1926-28, and represented that Society on the American Engineering Council in 1929-1931. He is a member of the American Society of University Professors and Director of the Guggenheim Aeronautical Laboratories, University of Washington.

For Treasurer—Merrill F. Blankin, born in Philadelphia on March 17, 1898, was educated in the public schools of that city and attended Drexel Institute of Technology.

Mr. Blankin, before joining the Haynes Selling Co., in 1917, spent one year as transitman and draftsman in the Surveying Corps, City of Philadelphia. He entered the employ of Haynes Selling Co. as draftsman and successively became sales engineer, secretary, vice-president and was elected president in 1931.

He joined the ASHVE in 1919 as Junior Member, was elected to Associate grade in 1927 and full Member in 1928. He became active in Philadelphia Chapter Society activities in 1919, serving on many committees. He was elected treasurer of the Chapter, then vice-president and finally president in 1933. He has attended all the Annual Meetings of the Society since 1921, with the exception of two, and has attended all Semi-Annual Meetings since 1924. He also served on several meeting committees. In 1939 he served as treasurer and for two years was a member of the Committee on Admission and Advancement, as well as on the special committee to prepare Code for Guidance of the Admission and Advancement Committee.

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John F. S. Collins, Jr., was born March 25, 1895, at Pittsburgh, Pa., and following his graduation from the public schools of that city, and after a short interruption due to the World War, he received his B.S. and C.E. degrees in 1919 from the University of Pittsburgh, School of Engineering.

Following several years spent with Morris Knowles, Inc., consulting engineer, he began a period of 17 years' employment with the subsidiaries of the Philadelphia Co., supplying gas, light and steam in Pittsburgh, which ended in August, 1939, when he became secretary-treasurer of the *National District Heating Association.*

In recent years he successively held the positions of supervisor of steam distribution and supervisor of steam utilization with the Allegheny County Steam Heating Co.

Mr. Collins has kept up his interest in University affairs. He is a past president of the *Engineering and Mines Alumni Association* and at present a member of Alumni Council and is active locally in the Phi Delta Theta Fraternity. He is the author of several papers on district heating; served as president of the Pittsburgh Chapter of the Society during 1938, and as a member of the Constitution and By-Laws Committee and the Heat Requirements of Buildings Committee of the Society.

As a member of the *NDHA* he was chairman of the Distribution Committee for several years, and in 1938 was chairman of the Commercial Relations Committee for the Association.

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Everett N. McDonnell was born on June 25, 1893 at Des Moines, Ia., where he received his early education. Graduating from West High School, Des Moines, he entered the Iowa State College, Ames, Ia., and later attended Cornell University, Ithaca, N. Y., where he studied mechanical engineering.

During the War he served as 2nd Lieutenant, 301st Heavy Tank Corps, taking part in the Somme offensive in France in 1918.

Prior to forming his own business, McDonnell & Miller, Chicago, of which he is vice-president, Mr. McDonnell was secretary of the McAlear Mfg. Co.

He has been a member of the Society for the past 16 years, affiliating himself with the Illinois Chapter in 1923, and a member of the Guide Publication Committee from 1934 to 1939. He is at present chairman of the Speakers Bureau Committee.

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Thomas H. Urdahl, born July 8, 1902 at Colorado Springs, Colo., received his elementary and high school education in Madison, Wis., and Philadelphia, Pa., and later studied mechanical engineering at Swarthmore College, Swarthmore, Pa., and in addition studied physics, economics and business law.

In 1922 he entered the employ of Col. P. M. Anderson, consulting engineer, Washington, D. C., and was given the responsibility of design, supervision, coordination and disbursement on construction projects.

In 1927 he was associated with A. M. Daniels, consulting engineer and technical author, Washington, D. C., preparing plans and specifications and supervising installation of heating and ventilating equipment, undertaking fuel conservation and combustion analyses, compiling data and writing advisory reports.

Mr. Urdahl joined the Society in 1930 and has been an active member, serving on the Committee on Admission and Advancement, the Committee on Code of Procedure for Guidance of Committee on Admission and Advancement, as well as serving on the Executive and Finance Committees of the Committee on Research. He is chairman of the Technical Advisory Committee on Weather Design Conditions, and is serving on the subcommittee on Climate and Season, and at present is President of the Washington, D. C., Chapter. He is also consultant to the Social Security Board, a member of the Advisory Committee to the President's Committee on Civil Service Improvement, a lecturer in engineering at George Washington University, past president of Washington, D. C., Chapter of *AAE*, and holds membership in many scientific, civic and engineering organizations.

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C.-E. A. Winslow was born in Boston, February 4, 1877. He received his S.B. in 1898 and S.M. in 1899 from Massachusetts Institute of Technology, and received an honorary degree of Dr. of Public Health in 1918 from New York University.

Professor Winslow taught in the department of Biology and Public Health at Massachusetts Institute of Technology from 1898-1910, at which time he became Associate Professor of Biology, College of the City of New York, which he held until 1915. From this date to the present he has been Professor of Public Health at Yale University.

He served as chairman of the New York Commission on Ventilation from 1913-1923. In 1932 he became Director of the John B. Pierce Laboratory of Hygiene, New Haven, Conn.

Professor Winslow, besides conducting researches and publishing numerous papers on relation of atmospheric conditions to human health and comfort, including ventilation, published several books, and presented numerous technical papers before the Society.

Professor Winslow is the Technical Adviser of the Committee on Research, and General Chairman of the Technical Advisory Committee on Relations of Air Conditions to Human Health and Comfort, and is also serving on the Committee on Radiation and Comfort.

Low-Cost Housing Discussed at Washington

October 11, 1939. The first regular meeting of the Washington, D. C. Chapter was attended by 78 members and guests.

R. K. Thulman, mechanical engineer of Federal Housing Administration, the guest speaker, pointed out the necessity for a complete change in thought on the part of manufacturers in the heating industry with respect to units for low-cost housing, and outlined the steps which the FHA has taken to promote more uniform standards of design. FHA regulations on low-cost houses devote much space to a description of all items of construction with the exception of heating, which is given only minimum attention, whereas it should receive the major emphasis in construction since fuel and operating costs are one of the most vital elements in the occupants' budgets.

The Chapter enjoyed meeting and speaking with M. C. Gillett, Philadelphia, who was a welcome visitor at this meeting.

On October 21, under the direction of Lt. Comdr. R. M. Watt, Jr., the members of the Washington, D. C. Chapter visited the David W. Taylor model basin at Carderock, Md.

Aerial View of Downtown Cleveland

Cleveland Prepares Program for 46th Annual Meeting

THE 46th Annual Meeting of the Society will open at the Hotel Statler, Cleveland, O., during the fourth week of January 1940, and the Northern Ohio Chapter will act as hosts for the occasion. Registration will start on Monday morning, January 22, and the entire day will be devoted to committee meetings and conferences. At 2 p. m. the officers of the Society will participate in the opening of the 6th International Heating and Ventilating Exposition at Lakeside Hall.

Social activities planned by the Committee on Arrangements will commence on Monday with a reception for visiting ladies, a social hour from 5 to 6 p. m., and an informal get-together party at 10 p. m.

On Tuesday, Wednesday and Thursday technical sessions will be held at which committee reports and papers will be presented. Four of the five sessions will be held in the Hotel Statler, which is the headquarters for the Society meeting, and on Wednesday afternoon a joint meeting will be held with the *National Warm Air Heating and Air Conditioning Association* at the Hollenden Hotel. The presidents of the respective organizations, J. F. McIntire of the ASHVE and L. R. Taylor of the *NWAHACA* will be in charge of the meeting. The speakers will be Charles H. Mylander, Columbus, O., and Prof. A. P. Kratz, University of Illinois.

The ladies program will provide an active day on Tuesday with a visit to Severence Hall, luncheon at Crosby's and a visit to the Electrical Housekeeping Institute in Nela Park.

A social hour for members and ladies is scheduled on Tuesday for 5 p.m., and at 8 p.m. informal theater parties will be enjoyed. For the men a stag smoker is planned at the Hollenden Hotel under the auspices of the *NWAHACA*, and all Society members are invited.

Wednesday morning is reserved for a shopping trip and in the afternoon the ladies will enjoy a bridge, tea and fashion show, and in the evening the annual banquet and dance will be held in the grand ballroom of the Hotel Statler.

During the week various inspection trips are scheduled and members will have the opportunity of seeing several industrial plants, including Republic Steel's new strip mill, the plant of the Industrial Rayon Corp., the Bryant Heater Mfg. Co., the laboratories of the *American Gas Association* and the Case School of Applied Science.

The work of the Committee on Arrangements is being conducted by L. T. Avery, General chairman, and the following committees are hard at work planning events for the entertainment of visiting members: G. L. Tuve, Honorary Chairman; Philip Cohen, Vice-Chairman, and L. S. Ries, Vice-Chairman; *Technical Sessions*, C. F. Eveleth, chairman; *Publicity*, John Paul Jones, chairman; *Finance*, E. W. Gray, chairman; *Inspection Trips*, C. A. McKeeman, chairman; *Attendance*, D. L. Taze, chairman; *Banquet*, F. A. Kitchen, chairman; *Transportation*, A. L. Vanderhoof, chairman; *Entertainment*, H. E. Wetzell, chairman; *Registration-Reception*, Paul Gayman, chairman; and *Ladies*, Mrs. W. R. Rhoton, chairman.

The Sixth International Heating and Ventilating Exposition—the Air Conditioning Exposition—promises to be one of the most successful in this biennial series, according to indications a month in advance of the show. Nearly 300 manufacturers have engaged exhibit space and plans for equipment installations and exhibit presentation are going forward rapidly.

46th Annual Meeting

American Society of Heating and Ventilating Engineers
Cleveland, Ohio—Hotel Statler—January 22-25, 1940

Monday, January 22

8:30 a. m. REGISTRATION—(Mezzanine Floor) — Hotel Statler
Ladies Reception—(Mezzanine)—Lattice Room
(Please register for all trips and secure tickets for the Get-together Party and Banquet immediately upon arrival as a courtesy to the Committees in charge of these events)
9:30 a. m. Conference of Chapter Delegates (Pine Room)
10:00 a. m. Council Meeting (Tavern Room)
10:30 a. m. Committee Meetings
2:00 p. m. Opening of 6th International Exposition
2:30 p. m. Nominating Committee Meeting
5:00 p. m. Social Hour—Mezzanine—Lattice Room
10:00 p. m. Get-Together Party (Informal Dance)—Admission $1.00 per man—Ladies Free (Euclid Ballroom)

Tuesday, January 23

8:30 a. m. REGISTRATION—(Mezzanine Floor) — Hotel Statler
(The schedule of technical sessions is arranged to permit ample time for visits to the Exposition and other engagements)
9:30 a. m. TECHNICAL SESSION—(Grand Ballroom)—Hotel Statler—Reports and 3 Papers
9:30 a. m. *Ladies Tour—Severence Hall, Cleveland Orchestra Rehearsal
12:00 noon *Ladies Lunch—Crosby's Restaurant (E. 105th and Carnegie)
1:30 p. m. *Ladies Tour—Nela Park, Electrical Housekeeping Institute (Trip starts from Crosby's)
2:00 p. m. TECHNICAL SESSION—(Grand Ballroom)—Hotel Statler—Reports and 3 papers.
5:00 p. m. Social Hour—(Mezzanine)—Lattice Room
8:00 p. m. Informal Theater Parties
10:00 p. m. Stag Smoker—(Grand Ballroom)—Hotel Hollenden—Sponsored by the *National Warm Air Heating and Air Conditioning Association* for their members and guests and those of the American Society of Heating and Ventilating Engineers—A colorful event after Exposition hours—Speechless—Informal—Secure tickets at Registration Desk

Wednesday, January 24

9:30 a. m. TECHNICAL SESSION—(Grand Ballroom)—Hotel Statler—Reports and 3 papers
10:00 a. m. Ladies—Open for Shopping
2:00 p. m. TECHNICAL SESSION—Joint Meeting with *National Warm Air Heating and Air Conditioning Association* (Grand Ballroom) Hotel Hollenden
2:30 p. m. Ladies Bridge Party (Halles Tea Room)
4:00 p. m. Ladies Tea and Fashion Show (Halles Tea Room)
7:00 p. m. Annual Banquet and Dance—(Grand Ballroom)—Hotel Statler
Toastmaster—Walter Klie

Thursday, January 25

10:00 a. m. TECHNICAL SESSION—(Euclid Ballroom)—Hotel Statler
Reports and 3 papers
Installation of Officers
1:00 p. m. *Industrial Rayon Corp.—Painesville* (Windowless completely Conditioned Plant)—(Transportation—$1.00 per person round trip)
1:30 p. m. *Inspection Trips
1:30 p. m. Council Meeting (Tavern Room).

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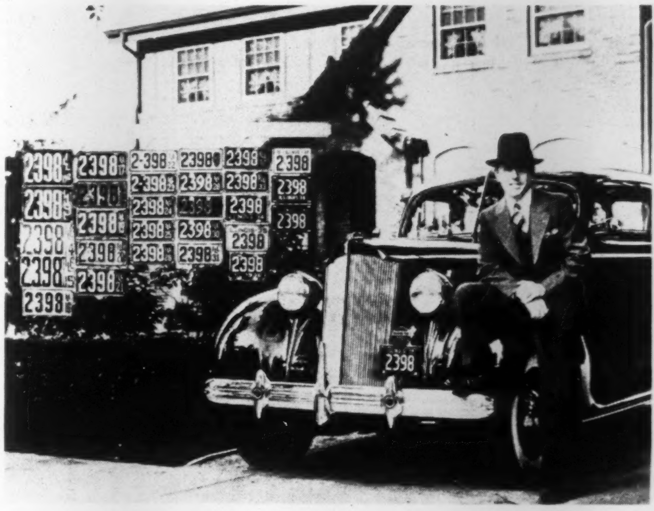
*Note on Ladies Trip Tuesday and Men's Inspections Trips. Sign up for transportation at Registration Desk. Limit of 30 persons for the inspection trip to Industrial Rayon due to necessity of guides. Additional trips will be planned for Friday if desired.



E. W. Rietz, Chicago, Ill.

2398 Ill. — A RECORD — 179 Man.

Of a population of about 150 million on the North American continent over 25 million drive automobiles, and from this legion of people, strangely enough, two persons in the same company have the distinction of holding the same auto license plate number in their respective communities since the year 1912.

Both men are members of the Society and are portrayed in the accompanying pictures—Elmer W. Rietz, General Sales Manager, Specialty Division, Powers Regulator Co., Chicago, and Paul L. Charles, Winnipeg manager for the same company. Neither Mr. Rietz nor Mr. Charles, who have known each other for almost 20 years, was aware of the fact that the other had a collection of license plates dating back to 1912.

Bob Ripley brought that matter to public attention in one of his "Believe It or Not" cartoons in 1938, which showed that Mr. Charles had held the same auto license number for 28 years.

Ripley used Mr. Charles and his collection of license plates as the subject of the cartoon, which was seen by many Powers representatives throughout the country, and it was then discovered that Elmer W. Rietz likewise had kept a collection of his license plates since 1912, each with the same number.

They both hope to continue adding to their unique collection and would be interested to learn whether there are any other ASHVE members who can equal their record.

P. L. Charles, Winnipeg, Man., Canada

Atlanta Meeting Highly Successful

Atlanta, Ga. — October 30-31, 1939

J. F. McIntire, Detroit, Mich.
President—1939

ATLANTA was the scene of the first Fall Meeting of the Society, held October 30-31 at the Atlanta Biltmore Hotel. Members from 22 states and Canada made up the total registration of 180 who attended the three technical sessions and enjoyed the social events, arranged by the Atlanta Chapter. Pres. J. F. McIntire called the first Fall Meeting into session at 9:30 a. m., Monday, October 30, and C. L. Templin welcomed the visiting members, guests and ladies.

FIRST SESSION—

Monday, October 30, 1939—9:30 a. m.

Prof. G. L. Tuve, Cleveland, presented his paper entitled The Use of Air-Velocity Meters by Professor Tuve, D. K. Wright, Jr., and L. J. Seigel (complete paper published in November, 1939, ASHVE Journal Section, *Heating, Piping and Air Conditioning*), outlining the results of research sponsored by the ASHVE in cooperation with the Case School of Applied Science. The paper reported on three years of investigation covering methods of instrument calibration and a study of the practical use of instruments for measuring air stream characteristics and air quantities. The authors emphasized the point that accurate calibrations are necessary and said that calibration methods for all instruments should be standardized. The paper was illustrated by lantern slides and proved to be of exceptional interest to the members present.

Prof. A. P. Kratz presented written discussions prepared by M. K. Fahnestock and A. E. Hershey of the research staff of the University of Illinois The various questions asked were answered by D. K. Wright, Jr., one of the authors. The written comments of Prof. D. W. Nelson, University of Wisconsin, and C. H. Randolph, Milwaukee, were read by the secretary of the Society, A. V. Hutchinson. S. H. Downs, Kalamazoo, and J. L. Blackshaw, Atlanta, presented oral discussions, and the final closure for the authors was made by Mr. Wright.

A discussion of thermostatic performance was given by B. E. Shaw, Goshen, Ind., in the paper entitled A Study of Certain Factors That Affect the Droop Characteristics of Thermostats by B. E. Shaw and La Verne Lyon (complete paper published in December, 1939, ASHVE Journal Section, *Heating, Piping and Air Conditioning*), which was illustrated by slides of tabulated test data and diagrams of apparatus used in the various tests reported. The authors presented five specific conclusions with reference to the cause of droop and offered the suggestion that further investigation was essential.

SECOND SESSION—

Monday, October 30, 1939—2:00 p. m.

The afternoon program consisted of four papers. President McIntire introduced C. T. Baker, vice-chairman of the Committee on Arrangements, who presented his paper Food Preservation in the South (complete paper published in December, 1939, ASHVE Journal Section, *Heating, Piping and Air Conditioning*), wherein he described methods employed in Georgia and the Carolinas for the use of air conditioning in the preservation and storage of perishable crops. He also described the design of several plants for maintaining correct temperatures and humidities. Those taking part in the oral discussion were Messrs. Carter and Boester, St. Louis, Oaks and Fleisher, New York, Lewis, Cincinnati, and C. P. Lichty, Birmingham, Ala.

The subject of application of storage refrigeration was discussed by Carl F. Boester in his paper entitled The Application of Storage Refrigeration to Air Conditioning (complete paper published in November, 1939, ASHVE JOURNAL SECTION, *Heating, Piping and Air Conditioning*), which describes the design and operating characteristics of installations using ice accumulating evaporators. Mr. Boester gave a careful analysis of the usage factor and also gave some data on operating costs. In the discussion questions were asked by C. T. Baker, John Carter, F. J. Dean, Jr., F. B. Herty, and W. L. Fleisher.

F. C. Houghten, Director of the Society's Research Laboratory, presented the paper entitled A Standard Air Filter Test Dust by Frank B. Rowley and Richard C. Jordan. (complete paper published in October, 1939, ASHVE JOURNAL SECTION, *Heating, Piping and Air Conditioning*). This paper resulting from the cooperative research sponsored by the ASHVE and the Engineering Experiment Station of the University of Minnesota, describes the fundamental requirements of dust used for filter work, and in the conclusion points out that dusts are of two general classes insofar as they affect air filter ratings. Some oral comments were given by W. L. Fleisher, chairman of the Society's Committee on Research, and a prepared discussion was presented by Arthur Nutting, Louisville, Ky.

The final paper in the afternoon session was given by John H. Carter, St. Louis, Mo., in his paper entitled An Analysis of the Air Conditioning Contractor's Business Relationships. (complete paper published in November, 1939, ASHVE JOURNAL SECTION, *Heating, Piping and Air Conditioning*). The author covered the subject of customers' relations, consultant's role, the contractor's and distributor's obligations in the field of air conditioning and pointed out that there must be a proper balance between the business and the technical sides for a contractor to operate successfully.

Get-Together Luncheon

On Monday at 12:30 p. m. a get-together luncheon for the members and ladies was held in the main dining room of the Atlanta Biltmore Hotel, and C. L. Templin, president of the Atlanta Chapter, was the master of ceremonies. The guests at the head table were introduced after which Dr. M. L. Brittain, president of Georgia Tech, addressed the group on Technology and Southern Industry. In his remarks Dr. Brittain pointed out that there was a fertile field for the type of research conducted by the Society in the South and offered the facilities of Georgia Tech at any time for cooperative research investigation.

At the conclusion of the afternoon technical session members and ladies gathered for the Friendship Hour and enjoyed a musical program and appropriate refreshments.

Banquet

The outstanding social event of the meeting was the dinner and dance held in the ballroom of the Atlanta Biltmore on Monday evening. Oliver J. Prentice acted as toastmaster and introduced the Society officers and Council, and pointed out that 14 of the 17 men were present for this meeting. He noted that in the audience were W. H. Driscoll, past president of the Society, W. J. Olvany, president of the *Heating, Piping and Air Conditioning Contractors' National Association*, and the presidents of several chapters, H. E. Sproull, Cincinnati, O. O. Oaks, New York, L. P. Saunders, Western New York, Tom Brown, Chicago, Prof. R. B. Rice, Raleigh, and C. L. Templin, Atlanta.

President's Address

Pres. J. F. McIntire was called upon for a brief talk and said:

> "Professional engineering societies depend largely on research done in private laboratories for advancement. The ASHVE is the exception—20 years ago we established our own Laboratory at Pittsburgh in connection with the Bureau of Mines.
>
> "The purpose was to have a laboratory dedicated to the conduct of fundamental research. Commercial testing was barred. An important function of the Laboratory has been to supply basic data for the development of codes and standards.
>
> "The Government furnishes, without charge, space, light, heat, technical assistance and shop service, thus increasing the results per dollar of our expenditures.
>
> "The scope of the research activities of the Society is also greatly extended by means of cooperative agreements with such universities as California, Illinois, Minnesota, Pennsylvania, Pittsburgh, Wisconsin, Lehigh, Princeton, Agricultural and Mechanical College of Texas, Case School of Applied Science, Michigan College of Mining and Engineering, Massachusetts Institute of Technology and U. S. Navy.
>
> "So you can see why we were so interested at our luncheon today when President Brittain suggested a cooperative agreement between Georgia Tech and the Society.
>
> "Our Chairman of Research, W. L. Fleisher, vice-chairman J. H. Walker and the Director of our Research Laboratory, F. C. Houghten, are in attendance at this meeting and you can be sure that they will not leave Atlanta without following up Dr. Brittain's suggestion. Cooperative agreements avoid duplication of effort and coordinated activities to produce maximum results per dollar of expenditure. Many problems need investigation in all three fields of air conditioning, industrial, commercial and comfort. This community is interested in all of these."

The guest of honor for the occasion was Robert T. Jones, well known Atlanta attorney and famous golfer, who graduated from Georgia Tech as a mechanical engineer and found that there was a lot of engineering in golf, but that golf practice seriously curtailed the practice of engineering. He recalled some of his early experiences in a rather brief engineering career.

The speaker of the evening was O. B. Keeler, well known writer and commentator on sports, who is often referred to as "Bobby Jones Boswell." He delighted the audience of 225 with some amusing stories and gave a comprehensive review of interesting events in the sports world, and described some of the title matches played by Bobby Jones on many golf courses throughout the world, and also turned back some of the pages of baseball, football, tennis and boxing history.

During dinner instrumental music was played by Forrest Traylor and Forrest Traylor, Jr., and a novelty number by Bobby Staples. At the conclusion of dinner

Harry Hearn and his orchestra played music for dancing.

THIRD SESSION—

October 31, 1939—9:30 a. m.

On Tuesday morning the final technical session was called to order by Pres. J. F. McIntire, who introduced F. B. Lanham, research agricultural engineer, University of Georgia, who presented his paper on Agriculture Has Engineering Problems in Heating and Ventilating. (complete paper published in December, 1939, ASHVE JOURNAL SECTION, *Heating, Piping and Air Conditioning*). Of particular interest were his descriptions of artificial drying of hay and the curing and storing of sweet potatoes.

Lester S. O'Bannon, research engineer, University of Kentucky, Lexington, presented his paper dealing with A Laboratory for Use in Determining the Influence of Various Temperatures and Relative Humidities on the Final Quality of Air-Cured Tobacco. (complete paper published in November, 1939, ASHVE JOURNAL SECTION, *Heating, Piping and Air Conditioning*). This paper reported on some original research work and included a detailed description of the equipment and controls used to determine desirable temperatures and humidities for tobacco curing.

The concluding paper of this session was given by Paul D. Close, Chicago, in his paper entitled Permissible Relative Humidities in Humidified Buildings. (complete paper published in December, 1939, ASHVE JOURNAL SECTION, *Heating, Piping and Air Conditioning*). The author gave valuable data on the subject of condensation which occurs on the interior surfaces of buildings whenever such surfaces are below dew-point temperatures. He presented an ingenious chart for quickly determining the point at which condensation occurs on walls, roofs or glass under various atmospheric conditions.

Resolutions

First Vice-President Giesecke inquired whether there was any unfinished business and hearing no response, asked if there was any new business to be brought before the meeting, and Merrill Blankin, John Everetts, Jr. and G. L. Wiggs, Montreal, offered the following resolutions which were unanimously adopted:

Whereas, this concludes not only the first Fall Meeting of the Society ever held and the first meeting held in the deep South, but it concludes one of the most successful and delightful meetings of the Society.

We wish to express and record the hearty appreciation and the sincere thanks of the Society.

To the Officers of the Atlanta Chapter and particularly its Committee on Arrangements for the splendid program and their untiring efforts in making this meeting a success.

To the local newspapers and trade publications for their cooperation and publicity.

To the Atlanta Biltmore Hotel for their fine accommodations and efficient service.

To the Atlanta Convention and Visitors Bureau for their great help and for arranging to broadcast Mr. Kent's speech over radio station WSB.

To the transportation companies for their excellent service.

To the various speakers for the time and effort they devoted to the preparation and presentation of their papers.

And lastly, but not least, to the ladies, without whose presence the meeting would not have been complete, and who so graciously upheld the high traditions of the South.

The ladies committee was very active during the two-day meeting and provided sight-seeing and shopping trips for the visiting ladies. All enjoyed a breakfast-bridge on Tuesday morning. The sight-seeing trips included the residential section, Wren's Nest, the home of Joel Chandler Harris, the author of Uncle Remus stories, and the home of Margaret Mitchell of "Gone With the Wind" fame. A group of 25 visited the Cyclorama depicting the battle of Atlanta. At the breakfast-bridge 22 ladies were present and table prizes were awarded to Mmes. J. F. McIntire, F. E. Giesecke, M. C. Beman, Mrs. Adams, and Miss Dorothy E. Gulbransen. Each visiting lady was presented with an attractive souvenir, loose powder compact.

On Tuesday afternoon some of the members visited Georgia Tech, the Exposition Cotton Mills, Techwood Housing Project, and the Coca-Cola bottling plant, while several foursomes toured the East Lake Country Club course to test their skill as golfers.

Many of the members arrived in Atlanta on Saturday morning, October 28, and the Reception Committee was on hand to greet them at the Atlanta Biltmore. A group of 16 attended the football game and saw Georgia Tech beat Auburn 7 to 6. Others went to the East Lake Country Club for a round of golf.

Council

On October 29, at 10:00 a. m. President McIntire opened the Council meeting attended by 14 members.

During the afternoon the Council members enjoyed a sight-seeing trip through Atlanta, and at 4:00 p. m. a group of 30 members and ladies attended the Song Service of negro spirituals given by the Big Bethel Choir of 75 voices in the Bethel A. M. E. Church.

L. F. Kent
General Chairman

C. T. Baker
Vice-Chairman

C. L. Templin
President

T. T. Tucker
Secretary

Committee on Arrangements—Atlanta Chapter

ANNUAL REPORTS OF LOCAL CHAPTERS

Atlanta

At the *January 1939* meeting of the Atlanta Chapter F. J. Kurth, as guest speaker, addressed the meeting on air distribution and air flow. There were 50 members and guests in attendance.

The *February* meeting had John Haines as the speaker of the evening. Mr. Haines gave an interesting talk on controls, which was followed by a discussion. The attendance at this meeting was 12 members and 17 guests.

The regular monthly meeting was held on *March 7* with an attendance of 24 members and guests. C. T. Baker gave a talk on Our Part in the Society's Activities, which was followed by a question and answer period covering several specific actions taken by the Atlanta Chapter. Secretary T. T. Tucker then spoke briefly on Progress in the Atlanta Chapter. At this meeting it was decided to hold a special meeting on *March 20* in honor of Pres. J. F. McIntire. At this special meeting, which was attended by 32 members and guests, Pres. McIntire gave an interesting presentation on The Birth of Air Conditioning and Its Future.

The *April* meeting, with 27 members and guests in attendance, had as its guest J. A. Donnelly, Largent, W. Va., who spoke on Atlas of Agriculture.

H. D. Cutter, guest speaker at the *May* meeting, addressed the meeting on fire hazards of air conditioning. There were 14 members and guests present at this meeting which closed the 1938-39 season of the Atlanta Chapter.

The officers who served during this season, 1938-39, are:

President—C. L. Templin
Vice-President—S. W. Boyd
Secretary—T. T. Tucker
Treasurer—C. B. Cole
Board of Governors—C. T. Baker and E. W. Klein.

The Committees functioning during the 1938-39 season are as follows:

Membership—E. W. Klein, chairman; C. E. Brockinton, vice-chairman; and M. M. Crout.
Finance—Leo Sudderth, Jr., chairman.
Publicity—G. H. Brodnax, chairman; L. F. Kent, vice-chairman.
Entertainment and Program—L. L. Hamilton, chairman; F. L. Laseter, vice-chairman; and R. E. Nolan.

Michigan

The 1938-39 season of the Michigan Chapter opened with the *October* meeting with 80 members and guests present at the L'Aiglon. Prof. Frank B. Rowley, director of the engineering experiment station, University of Minnesota, was the guest speaker. Professor Rowley discussed the problem of condensation within walls.

The *November* meeting, with an attendance of 100 members and guests, heard Prof. C. P. Yaglou, associate professor of industrial hygiene, Harvard University, give an interesting talk on the health aspects of air conditioning.

R. C. Loughead, chief engineer, Michigan Inspection Bureau, discussed fire hazards and fire protection in air conditioning systems at the *December* meeting of the Chapter. G. F. Emery, chief inspector of bureau of building and safety engineering, City of Detroit, also spoke and his topic was on the Proposed Air Conditioning Code for the city of Detroit. There were 50 members and guests in attendance.

At the *January* meeting the Chapter members and guests, numbering 125, were the guests of the Detroit Edison Co. Following dinner there was an inspection trip through the Service Building of the company, which was followed by an interesting talk by J. H. Walker on the features of the new building.

The *February* meeting was given over to the annual Valentine Dance held at Dearborn Inn, with 140 members, guests and friends.

Pres. J. F. McIntire, Detroit, discussed the history of the Michigan Chapter at the *March* meeting and then gave a short resumé of the air conditioning industry. J. H. Walker, vice-chairman of the Committee on Research, discussed the activities of the Research Committee and of the Research Laboratory of the Society at Pittsburgh, which was followed by an interesting presentation of the physiological response to atmospheric environment by F. C. Houghten, Director of the Society's Research Laboratory.

The *April* meeting had as its guest C. T. Olmsted, secretary of the State Board of Registration of Professional Engineers, who discussed the recently enacted Registration Act. Dr. F. R. Bichowsky, consulting engineer, spoke on the subject of dehumidification in air conditioning, with particular reference to chemical dehumidification for industrial applications.

The 1938-39 season closed with the May meeting consisting of the annual golf get-together and the election of the officers to serve for the 1939-40 season as follows:

President—W. C. Randall
Vice-President—G. H. Tuttle
Secretary—W. H. Old
Treasurer—J. S. Kilner
Board of Governors—M. B. Shea, F. J. Linsenmeyer, S. S. Sanford and J. S. O'Gorman, Jr.

The following will serve as Committee Chairmen: *Program and Publicity*, G. H. Tuttle; *Membership*, E. H. Clark; *Reception*, R. R. Bishop; *Constitution, By-Laws and Codes*,—S. S. Sanford.

Minnesota

The opening meeting of the season of the Minnesota Chapter was held on *September 12, 1938*, with 37 members and guests present. The speakers were Secy. Harroun, of the *Minneapolis Heating and Piping Contractors' Association* and Secy. Scherer, of the *Minneapolis Warm Air Heating Association*, and the topic discussed was the contractor's viewpoint of the heating ordinance of the City of Minneapolis.

The *October* meeting was Past President's night and had 105 members and guests in attendance. Albert Buenger gave an interesting talk on reducing the cost of air conditioning.

The *November* meeting had 90 members and guests present and was the annual party of the Chapter, which was held at Eaton's Ranch.

There were 110 members and guests in attendance at the *November* meeting, which was held in conjunction with the Seminar conducted at the University of Minnesota and the Minnesota Chapter. Pres. J. F. McIntire was the guest of the evening and other speakers were F. C. Houghten, director of the ASHVE Research Laboratory, Prof. A. P. Kratz, University of Illinois, Dr. Charles Sheard, Mayo Clinic, Rochester, Minn., and Dr. Keys, University of Minnesota.

The next meeting of the Chapter was on *January 9, 1939*, at which time Prof. F. B. Rowley gave a brief talk on the Seminar and its accomplishments. The guest speaker of the evening was H. C. Rooks, La Crosse, Wis., whose subject was evaporative condensers. There were 33 members and guests present.

The *February* meeting was held at the Oak Street Laboratories, Engineering Experiment Station, University of Minnesota, with an attendance of 110 members and guests. Prof. A. B. Algren introduced the various members of the Experiment Station staff. Prof. F. B. Rowley outlined briefly the history of the Laboratories, their development and possibilities, the several research projects in progress and called attention to the facilities for large scale projects, and an inspection tour of the Laboratories followed.

R. E. Backstrom conducted a round table discussion on insulation at the *March* meeting, which was attended by 28 members and guests. Professor Rowley presented some recent findings on effects of attic ventilation on condensation within building walls and attics.

At the *April* meeting, at which 39 were in attendance, R. E. Backstrom presided at a discussion of an ordinance governing installation of air conditioning, warm air heating, air cooling and ventilating systems employing ducts, as presented by the National Board of Fire Underwriters and sent to the Minnesota Chapter for comments.

The *May* meeting was a joint meeting of the Manitoba and Minnesota Chapters held at Detroit Lakes, Minn., in honor of Pres. J. F. McIntire. The meeting was scheduled for the 13th and 14th, and President and Mrs. McIntire were present for both days. The Manitoba Chapter held their annual election of officers and both chapters enjoyed golf and sight-seeing tours.

Twenty members and guests were present for the *June* meeting, which consisted of the golf tournament and annual election of officers of the Minnesota Chapter who, elected to serve for the 1939-40 season, are as follows:

President—F. C. Winterer
Vice-President—M. H. Bjerken
Secretary-Treasurer—H. M. Betts
Board of Governors—J. E. Swensen and R. E. Backstrom.

North Texas

The North Texas Chapter of the Society was organized and held its first meeting in Dallas, *December 29, 1938* at which time the following officers were elected to serve the Chapter:

President—C. L. Kribs, Jr.
Vice-President—H. W. Skinner
Secretary-Treasurer—Leslie S. Gilbert
Board of Governors—R. K. Werner, T. H. Anspacher and J. C. Harrison.

The speaker at this organization meeting was W. L. Fleisher, New York, who addressed the Chapter on industrial air conditioning with special reference to high temperature and humidities.

The *January 1939* meeting was called to order by President Kribs, and the Constitution of the Society was adopted as the Constitution of the North Texas Chapter, and the proposed Chapter By-Laws were read and discussed and changes were incorporated.

R. K. Werner opened a general discussion based on the subject pride of workmanship at the *February* meeting. The effect on the character of work done by the engineer and the contractor and the resulting type of installation were discussed at length.

The *March* meeting was held at the Adolphus Hotel, Dallas, with 26 members and guests in attendance. Prof. F. E. Giesecke, College Station, introduced Pres. J. F. McIntire, who presented the charter to the North Texas Chapter, which was accepted in behalf of the Chapter by C. L. Kribs, Jr., president of the Chapter. Professor Giesecke spoke briefly on the fan testing facilities at College Station. President McIntire gave an interesting talk on the birth of air conditioning.

Vice-Pres. H. W. Skinner called the *April* meeting to order at the Texas Hotel, Fort Worth, with an attendance of 13 members and guests. The following were appointed to serve the North Texas Chapter for the season:

Membership Committee—E. Kirk Campbell, Jr., chairman; A. B. Ullrich, Jr., and M. W. Brown.
Program Committee—T. H. Anspacher, chairman; C. R. Gardner and A. M. Harris.

T. H. Anspacher reported on the papers presented at the Air Conditioning Conference, University of Texas, Austin, which caused considerable discussion.

The *May* meeting was held at the Texas Hotel, Fort Worth, with F. J. Kurth, New York, as guest speaker. Mr. Kurth addressed the Chapter on the subject of air diffusion.

The members met at the Stoneleigh Hotel, Dallas, for the *June* meeting, and Messrs. Campbell and Anspacher, committee chairmen, reported on the progress of their committees. The speaker of the evening, Dr. James H. Black, presented an teresting talk on air conditioning in connection with aller conditions.

The *July* meeting was also held at the Stoneleigh Hotel, a the speaker of the evening was P. N. Vinther, whose subj was design problems of an air cooling system using ice.

Pittsburgh

The Pittsburgh Chapter opened the season of 1938-39 with the *September* meeting at Stouffer's Restaurant with an attendance of 52 members and guests. R. D. Van Houten selected as his subject engineering sales presentation, pointing out that selling is the income side of business.

The *October* meeting had 48 present when Pres. J. F. Collins, Jr., called the meeting to order. The speaker of the evening was R. H. Heilman, who gave a resumé of heat transfer through pipe insulation and building material.

F. C. Houghten, director of the Society's Research Laboratory, was the guest of the evening at the *November* meeting. Mr. Houghten spoke on air conditioning in industry, reviewing the early work of the Laboratory and describing briefly the current program of cooperative investigation. There were 48 members and guests in attendance.

The *December* meeting was a social gathering devoted to dinner and dancing at the Fort Pitt Hotel with 60 attending.

The *January 1939* meeting was held as customary in the private dining room at Stouffer's Restaurant with an attendance of 46 members and guests. W. K. Estep spoke on a fire underwriter's views on heating and air conditioning systems, discussing the effect of the installation of heating and air conditioning systems on the fire hazard within buildings.

G. L. Simpson presented an interesting talk on adsorption dehumidification in air conditioning at the *February* meeting, which was attended by 55 members and guests.

The theory and practice of air distribution in air conditioning was the topic of discussion at the *March* meeting of the Pittsburgh Chapter. The subject was presented by F. J. Kurth, New York, N. Y., before an attendance of 70 members and guests.

The *April* meeting, with an attendance of 35, had for discussion the report of the committee appointed to study the proposed National Board of Fire Underwriters' Code for Air Conditioning.

The final meeting of the season was held on *May 8, 1939*, with an attendance of 35 members and guests. Dr. Paul B. Faragher, metallurgist, was the guest speaker of the evening. Dr. Faragher gave an interesting presentation on the scientific development of aluminum. He reviewed the early experiments which finally led to the electrolytic method now used. The meeting was concluded by the showing of a film tracing the production and manufacture of aluminum from the mine to a wide variety of finished products.

South Texas

At the organization meeting of the Chapter in Houston on December 28 the following Chapter officers were elected to serve for the 1938-39 season

President—R. F. Taylor
Vice-President—R. E. Chrone
Secretary—W. H. Badgett
Treasurer—I. E. Rowe
Board of Governors—J. A. Kiesling, C. A. McKinney and R. W. Kotzebue.

The *February* meeting of the newly organized South Texas Chapter was held on the 22nd at the Aggielan Inn, College Station. Prof. F. E. Giesecke, first vice-president of the Society addressed the chapter on the influence of heat storage capacity of walls upon the heating and cooling of large buildings, and discussed in general the research activities of the Society.

Dr. Charles Sheard, director of biophysical research, Mayo Foundation, Rochester, Minn., gave an interesting talk at the

March meeting on the thermal interchange between the body and its environment.

At the *May* meeting, F. J. Kurth, New York, N. Y., covered the underlying theories of air flow and air diffusion and gave a demonstration showing air distribution, aspiration and recirculation effects. At this meeting the following officers were elected to serve the South Texas Chapter for the 1939-40 season:

President—C. A. McKinney
Vice-President—A. J. Rummel
Treasurer—R. M. Spencer
Secretary—D. S. Cooper
Board of Governors—A. F. Barnes and G. R. Rhine.

On August 18, 1939, the banquet in connection with the short course in air conditioning at the Texas A & M College, was considered as a special meeting of the South Texas Chapter, and John Howatt, chief engineer, Board of Education, Chicago, and Past President of the Society, gave an interesting talk relating to the responsibilities of the consulting engineer.

CANDIDATES FOR MEMBERSHIP

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 52 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge the members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by December 16, 1939, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

CANDIDATES	REFERENCES	
	Proposers	*Seconders*
Adair, J. S., Partner, Southern Equipment Co., New Orleans, La.	G. E. May C. B. Gamble	W. J. McKinney R. F. Hahn
Anderson, Einar, Sales Engr., Vulcan Iron Works, Ltd., Winnipeg, Man., Can.	J. B. Steele William Glass	William Worton Frank Thompson
Berry, Robert U., Dist. Mgr., General Electric Co., Dallas, Tex.	C. L. Kribs, Jr. Elliott Harrington	D. W. McLenegan F. H. Faust
Brissenden, C. W., Htg. Engr., Portland General Electric Co., Portland, Ore.	T. E. Taylor C. E. Heinkel	B. W. Farnes Albert Freeman
Burns, F. G., New Orleans Public Service, New Orleans, La.	O. E. Gammill, Jr. C. B. Gamble	F. S. McLaren G. E. May
Chester, F. L., Mgr., W. G. Chester & Son, Winnipeg, Man., Can.	J. B. Steele G. C. Davis	R. L. Kent D. F. Michie
Clemens, J. D., Grad. Student, Purdue Univ., West Lafayette, Ind.	W. T. Miller L. V. Ludy (*ASME*)	H. G. Veneman (*ASRE*) A. W. Cole (*ASME*)
Cressy, L. V., Sales Engr., New Orleans, La.	C. B. Gamble G. E. May	F. S. McLaren O. E. Gammill, Jr.
Davis, D. W., Jr., Sales Engr., B. F. Sturtevant Co., Boston, Mass.	W. M. Wallace, II H. L. McDowell	M. D. Brown E. R. Harding
Denham, H. S., Malden, Mass.	James Holt H. C. Moore	C. E. Greene (*ASME*) C. M. Durgin (*ASME*)
Devlin, John, Partner, Devlin Bros., New Orleans, La.	C. B. Gamble G. E. May	F. S. McLaren O. E. Gammill, Jr.
Dillender, E. A., Htg. Engr., Houston Gas & Fuel Div. of United Gas Corp., Houston, Tex.	C. A. McKinney J. van O. Weaver	L. C. McClanahan D. S. Cooper
Dowdy, R. B., Sales Engr., Haydn Myer Co., Inc., Birmingham, Ala.	C. P. Lichty F. L. Hardy	H. C. Gause R. L. Murphree
Drum, L. J., Jr., Sales Engr., York Ice Machinery Corp., Birmingham, Ala.	H. C. Gause F. L. Hardy	C. P. Lichty R. L. Murphree
Dudley, W. H., Jr., Dist. Mgr., The Trane Co., New Orleans, La.	O. E. Gammill, Jr. C. B. Gamble	G. E. May F. S. McLaren
Dunlap, A. L., Assoc. Prof. Mech. Engrg., Tulane Univ., New Orleans, La.	G. E. May F. S. McLaren	O. E. Gammill, Jr. C. B. Gamble
Elizardi, Ralph, Design Engr., Leo S. Weil & Walter B. Moses, New Orleans, La.	C. B. Gamble G. E. May	O. E. Gammill, Jr. L. S. Weil
Friedler, J. J., Jr., So. Dist. Mgr., Ilg Electric Ventilating Co., New Orleans, La.	C. B. Gamble G. E. May	O. E. Gammill, Jr. J. M. Frank
Graham, F. D., Br. Mgr., York Ice Machinery Corp., New Orleans, La.	H. G. Chapin G. E. May	C. B. Gamble L. S. Weil
Gritzan, L. L., Vice-Pres. & Gen. Mgr., United Equipment & Supply Co., Washington, D. C.	T. H. Urdahl E. S. deWitt	J. T. Fisher A. C. Crawford
Guest, P. L., Jr., Sales Engr., Hoffman Specialty Co., Greensboro, N. C.	T. C. Cooke E. R. Harding	M. C. Gillett M. F. Blankin
Guest, R. B., Estimator & Engr., Guest & Viviano, New Orleans, La.	G. A. Hero, Jr. G. E. May	O. E. Gammill, Jr. C. B. Gamble
Healy, C. T., Dist. Repr., Minneapolis-Honeywell Reg. Co., New Orleans, La.	C. B. Gamble G. E. May	O. E. Gammill, Jr. F. S. McLaren
Helwick, N. J., Secy. & Engr., American Heating & Plumbing Co., Inc., New Orleans, La.	C. B. Gamble G. E. May	F. S. McLaren O. E. Gammill, Jr.

CANDIDATES	REFERENCES *Proposers*	*Seconders*
HERO, G. A., JR., Partner, Airflow Co., New Orleans, La.	C. B. Gamble G. E. May	F. S. McLaren O. E. Gammill, Jr.
HIGH, J. M., Mgr., Insulation Div., The Ruberoid Co., New York, N. Y. (*Advancement*)	W. J. Osborn R. V. Sawhill	A. F. Hinrichsen W. E. Heibel
HOLZER, R. J., JR., Mgr. & Engr., Holzer Sheet Metal Works, New Orleans, La.	C. B. Gamble G. E. May	F. S. McLaren O. E. Gammill, Jr.
KELLEY, F. J., Mfrs. Repr., New Orleans, La.	M. I. Levy G. E. May	C. B. Gamble H. L. Mueller (*Non-Member*)
KELLY, H. J., Sales Engr., New Orleans, La.	F. S. McLaren G. E. May	O. E. Gammill C. B. Gamble
KERR, G. C., Acoustical Engr., Taylor-Seidenbach, New Orleans, La.	F. S. McLaren C. B. Gamble	G. E. May O. E. Gammill, Jr.
KLUCKHUHN, F. H., Engr. & Draftsman, Eberly & Brand, Washington, D. C.	E. H. Lloyd P. H. Erisman, Jr.	H. M. Nelson F. M. Thuney
MORTON, P. S., Sales Engr., Automatic Heating & Cooling Supply Co., Chicago, Ill.	C. M. Burnam, Jr. H. E. Ryerson	M. W. Bishop H. J. Prebensen
NELSON, L. K., Assoc. Cons. Engr., James M. Todd, New Orleans, La.	G. E. May B. S. Nelson (*ASME*)	C. C. Crawford (*ASME*) J. M. Todd (*ASME*)
OESTERLE, A. L., Engr., Gulf Engineering Co., Inc., New Orleans, La.	F. S. McLaren O. E. Gammill, Jr.	G. E. May C. B. Gamble
PARKERSON, WILLIAM, Partner, Air Control Engrg. Co., New Orleans, La.	G. E. May C. B. Gamble	O. E. Gammill, Jr. F. S. McLaren
PARTLAN, R. L., Engr., J. W. Partlan Co., Detroit, Mich.	W. H. Old F. J. Feely	E. H. Clark W. C. Randall
PATTERSON, G. P., Engr., W. H. Sullivan Co., Greensboro, N. C.	E. R. Harding Harry Hoffman	W. M. Wallace, II F. E. P. Klages (*Non-Member*)
POWERS, E. C., Sr. Partner, E. C. Powers & Son, Philadelphia, Pa.	L. P. Hynes P. L. Pryibil	J. H. Hucker F. D. Mensing
PURINTON, I. H., Sales Dept., New Orleans Public Service, Inc., New Orleans, La.	G. E. May C. B. Gamble	O. E. Gammill, Jr. F. S. McLaren
RIVES, C. E., Steamfitter Helper, Houston, Tex.	D. S. Cooper C. A. McKinney	C. G. Crocker (*Non-Member*) A. W. Whitaker " "
SEIGEL, L. J., Test Engr., Cleveland Electric Illuminating Co., Cleveland, Ohio	G. L. Tuve D. K. Wright, Jr.	C. A. McKeeman J. R. Weske (*ASME*)
SHUMAN, LAURENCE, Mech. Engr., U. S. Housing Authority, Washington, D. C.	R. K. Thulman J. G. Vaughan, Jr.	G. R. Walz P. H. Erisman, Jr.
SKAGERBERG, RUTCHER, Sr. Mech. Engr., U. S. Housing Authority, Washington, D. C. (*Reinstatement*)	P. A. Croney T. H. Urdahl	F. M. Thuney W. E. Kingswell
SILVERA, AMERICO, Engr., Viana's Auto Supply, Aruba, Netherland, West Indies	R. V. D. Dunne L. L. Lewis	Walter Jones (*ASRE*) W. B. Rorison (*ASRE*)
STONE, F. M., Secy.-Treas., Sam Stone, Jr. & Co., Inc., New Orleans, La.	O. E. Gammill, Jr. G. E. May	F. S. McLaren C. B. Gamble
STORY, J. W., Engr., Leo S. Weil & Walter B. Moses, New Orleans, La.	L. S. Weil C. B. Gamble	O. E. Gammill, Jr. G. E. May
TROLESE, L. G., Engr., General Air Cond. & Heating Co., Oakland, Calif.	C. D. Williams C. E. Bentley	F. H. Varney T. J. White
TUCKER, R. E., Chief Draftsman, York Ice Machinery Corp., Houston, Tex.	R. M. Spencer A. M. Chase, Jr.	C. A. McKinney A. F. Barnes
WALDEN, H. K., Secy., Haydn Myer Co., Inc., Birmingham, Ala.	C. P. Lichty F. L. Hardy	H. C. Gause R. L. Murphree
WEAVER, J. VAN O., Air Cond. Engr., United Gas Corp., Houston, Tex.	C. A. McKinney E. N. Pettit, Jr.	A. B. Banowsky C. G. Crocker (*Non-Member*)
WEIL, L. S., Cons. Engr., Leo S. Weil & Walter B. Moses, New Orleans, La.	C. B. Gamble G. E. May	O. E. Gammill, Jr. F. S. McLaren
WESTENDARP, F. G., Chief Engr., Carrier Dept., Guinard Freres, Caracas, Venezuela, South America	R. V. D. Dunne V. S. Day	H. S. Traynor W. B. Rorison (*ASRE*)

CANDIDATES ELECTED

In the past issues of the JOURNAL of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Committee on Admission and Advancement and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. B-III, Sec. 8, of the By-Laws, the following list of candidates elected:

MEMBERS

FIRESTONE, M. T., Mgr., Carrier Air Cond. Div., Washington, D. C.

NOLAN, J. J., JR., Air Cond. Engr., United Clay Products Co., Washington, D. C.

ROSEN, E. J., Mgr., Temp. Control Dept., Parker-Carpenter, Inc., Oakland, Calif.

ASSOCIATES

HARTSOOK, G. S., JR., Mgr., Miller & Anderson, Front Royal, Va.

JUNIORS

GAIR, K. B., Sales Engr., B. F. Sturtevant Co., Grand Rapids, Mich.

Heating·Piping and Air Conditioning

January-December, 1939—Vol. 11, Nos. 1-12

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As will be noted, these abstracts are classified under general heads. In looking for information on a specific subject, it will be well to look through the abstracts under the most suitable heading, and also to look through those under other headings. For example, some of the heating articles also contain information on air conditioning, and vice versa, as the grouping has been made on the basis of the subject most prominently covered in the article.

The index to the Journal Section *of the* American Society of Heating and Ventilating Engineers *is separate (see page 797).*

This index does not include Equipment Developments; Book Reviews; Booklets, Reports, and Papers; Recent Trade Literature; Conventions and Expositions; Schools and Study Courses—departments appearing regularly each month. The Editor's Page in each issue includes items of news, comments on current events, etc. In the January, 1939, *issue a complete directory section was published covering heating, piping and air conditioning equipment for industry and large buildings.*

Air Conditioning

Advantages of Air Conditioning Museums
Vol. 11, *No.* 11. *November*, 1939. *p.* 682
Brief report of address made before annual convention of American Association of Museums by J. F. Kooistra; lack of comprehension of effect of humidity and temperature, as well as air filtering, is the greatest stumbling block in preservation of art objects; economic considerations; two bases upon which air conditioning may be proved economically sound; amount of money spent by average museum for cleaning, maintenance and rehabilitation; cost of owning and operating air conditioning equal to or less than the savings it brings.

Air Conditioning a Remedy for Rheumatism
Vol. 11, *No.* 1. *January*, 1939. *p.* 158 *(back section)*
Summary of address of Dr. Albert G. Young before annual convention of American Society of Refrigerating Engineers; studies show no recurrent attacks of rheumatic fever among patients who have entered Corey Hill hospital since it was equipped with complete air conditioning system.

Air Conditioning as Production Tool a Factor in Industrial Preparedness
Vol. 11, *No.* 12. *December*, 1939. *p.* 727
(Report of 1939 production conference of American Management Association); development of heating, ventilating and air conditioning equipment, by A. E. Stacey, Jr.; how air conditioning steps up production efficiency in various industries, by W. B. Henderson; a specialist's job; electrostatic air cleaning demonstrated by George F. Begoon; comfort and efficiency; air conditioned "plants of tomorrow"—Industrial Rayon Corp., Simonds Saw & Steel, Campana Corp.; piping at Campana plant; valves controlled by photo-electric "eye."

Air Conditioning Eliminates Afternoon Fatigue
Vol. 11, *No.* 4. *April*, 1939. *p.* 236
Experience with air conditioning at office building of Commercial Travelers Mutual Accident Association of America, Utica, N. Y.; building has five zones; air conditioning the vault.

Air Conditioning Helps Carry Out Theme of New York World's Fair, by Sanford R. Apt
Vol. 11, *No.* 2. *February*, 1939. *p.* 75
Buildings which will be air conditioned, which will be heated and which will be ventilated at New York World's Fair; types of heating systems; design temperatures; control; basis of design of cooling systems; types of systems; air conditioning and ventilating the Perisphere; temperature differential; amount of air circulated; tonnage of refrigeration to be in service at the Fair; ventilating requirements; water supply for air conditioning; insulation of buildings; partial list of air conditioned exhibits.

Air Conditioning in Industry—The Flour Mill, by George M. Sebree
Vol. 11, *No.* 1. *January*, 1939. *p.* 1
Importance of air in flour milling process; description of Tri-State Milling Co. mill, Rapid City, S. D. and Nebraska Consolidated Mills Co. plant at Grand Island, Neb.; "dollar and cents" reason for air conditioning; the control of evaporation; equilibrium relative humidities and moisture contents of some hard winter wheat stocks; temperature a factor; importance of proper construction and insulation of the building; the air conditioning cycle; description of the air conditioning equipment; utilization of heat; air distribution.

Air Conditioning Load Factors Are Improved by Storing Refrigeration, by D. C. Pfeiffer
Vol. 11, *No.* 7. *July*, 1939. *p.* 435
(Paper presented at University of Texas air conditioning conference); electrical consumption, average load per connected horsepower and kwhr per kw of customers' demand for office buildings and department stores in Dallas, Texas; annual load factor; storing refrigeration at night a method of improving load factor; types of storage systems; economic amount of storage; operating results of installation in 19 story Medical Arts Building, Dallas; description of the building and air conditioning plant; horsepower rating of motors; data on electrical consumption; demand and load factors; improvement of load factor through use of storage principle.

Air Conditioning's Many Uses Are Discussed at Eastern Conference
Vol. 11, *No.* 12. *December*, 1939. *p.* 739
Report of eastern air conditioning conference held at Lehigh University, Bethlehem, Pa., November 10-11, 1939; may expect a tremendous but gradual growth in air conditioning, according to A. R. Stevenson, Jr.; advantages of blast furnace air conditioning described by L. Logan Lewis; installation at Woodward Iron Co., Birmingham, Ala.; hotel guest room air conditioning, by John Hertzler; design considerations; summary of data on eight installations; air conditioning an educational building, by Samuel R. Lewis; methods of heating and ventilating school buildings; features of air conditioned school buildings; use of low pressure turbines for driving refrigeration machines; hospital air conditioning, by Charles F. Neergaard; costs per bed; research needed; uses of air conditioning in hospitals, by Dr. Murray B. Ferderber; specific applications; air as contagion vehicle, by W. F. Wells; promotion of air conditioning, by J. L. Rosenmiller; climatic data, by J. C. Albright; refrigeration storage, by Carl F. Boester; air conditioning for fruits and vegetables, by Charles Brooks.

Air Conditioning Service Engineer Tells How to Tune Up Installations, by Floyd M. Mayse
Vol. 11, *No.* 9. *September*, 1939. *p.* 555
Outline of points which should be covered in maintenance check-up of air conditioning installations; water group; air group; refrigerating group; electrical group; general group; troubles to look for and remedies.

Air Conditioning the New Mauretania
Vol. 11, *No.* 7. *July*, 1939. *p.* 431
Brief description of air conditioning plant on the new *Mauretania* of the Cunard White Star Line; refrigeration supplied from CO_2 machines; design conditions.

Air Conditioning Valuable to Public Health
Vol. 11, *No.* 5. *May*, 1939. *p.* 308
Abstract of address by Dr. Albert G. Young, medical director of Corey Hill hospital, before sales conference of the Edison Electric Institute; mortality of premature infants reduced by air conditioning; post-operative pneumonia reduced; broad field for improvement of public health by air conditioning; air pollution; death rate increases during heat waves; efficiency of office workers; elimination of noise.

Annual Air Conditioning Review
Vol. 11. *No.* 1. *January*, 1939. *p.* 33
Comparative data on number of installations and connected horsepower for air conditioning commercial and institutional buildings, industrial plants, and residences for 1937, the first eleven months of 1938, with totals as of December 1, 1938; cities and areas included represent population between 29 and 30 million; explanation of tabulation.

Area and Weight of Ducts, by Peter Franck
Vol. 11, *No.* 1. *January*, 1939. *p.* 20
Graph from which may be read the weights of various gages and the area for any length of run of a rectangular sheet metal duct; explanation of use.

Atmosphere and Efficiency
Vol. 11, *No.* 3. *March*, 1939. *p.* 124 *(back section)*
Brief review of booklet entitled "Atmosphere and Efficiency" reporting survey conducted by two research organizations; how air conditioning affects employee efficiency; typical answers to questions asked in survey.

Automobile Engines Running on Natural Gas Drive Compressors for Conditioning Theater, by Harry W. Smith, Jr.
Vol. 11, *No.* 11. *November*, 1939. *p.* 693
Automobile engines adapted to run on city natural gas supply drive two 60 ton compressors for air conditioning Beverly theater, Detroit, Mich.; engines equipped with high compression heads and fitted with governors; cost of operating gas engines during one season; batteries traded in each year; non-paraffin-base oil used for lubrication.

Bank Vaults Cooled
Vol. 11, *No.* 11. *November*, 1939. *p.* 663
Five ton air conditioning system for cooling safety deposit vault installed by United States National Bank, Omaha, Neb.; hinged duct swung out of position at night.

Big du Pont Building Being Air Conditioned
Vol. 11, *No.* 2. *February*, 1939. *p.* 78
Brief description of air conditioning of du Pont building, Wilmington, Del.; comprises almost 400,000 sq ft of floor space; cold water from refrigeration equipment with total capacity of 1200 tons to be conveyed to 42 multi-unit air conditioners; study of air conditioned buildings made by du Pont Co.

Blushing on Lacquered Pencil Parts Overcome by Gas Fired Dehumidifier, by Henry Hartmann
Vol. 11, *No.* 6. *June*, 1939. *p.* 356
Silica gel dehumidifier installed in finishing department at Eberhard Faber Pencil Co., Brooklyn, N. Y.; prevents shut down on high humidity days; cause of "blushing" on lacquered pencil parts; capacity and control of dehumidifier; results.

Check Charts for Air Conditioning Calculations, by J. M. Dean
Vol. 11, *No.* 2. *February*, 1939. *p.* 93
Charts Nos. 15 and 16 of a series, the first for figuring lb per min and cfm of air through coils and bypass, and the second for making capacity checks.

Circus Gets Air Conditioning, The, by F. B. Stubinger
Vol. 11, *No.* 5. *May*, 1939. *p.* 280
Brief description and diagram showing method of comfort cooling to be used by Ringling Brothers and Barnum and Bailey circus; equipment carried on trailers; cold air discharged into tent through 16 diffusers.

City Water Assists Cooling Tower When Wet Bulb Temperature Is High, by John Howatt
Vol. 11, *No.* 4. *April*, 1939. *p.* 214
Description of how city water is added to water from cooling tower to lower temperature of condensing medium for 100 ton steam jet refrigeration unit; reasons for doing; maintenance of cooling tower.

Copper Mine Extends Air Conditioning
Vol. 11, *No.* 8. *August*, 1939. *p.* 504
Magma copper mine, Superior, Ariz., to extend air conditioning from 3600 to 4000 ft level.

Decorating Air Conditioning Grilles
Vol. 11, *No.* 8. *August*, 1939. *p.* 487
Method of decorating air conditioning grilles in elaborately decorated ceiling in banking room; use of stencil design; improving appearance of transoms in offices blanked out by installation of ducts; foil reflects light, giving transoms appearance they had before being obstructed.

Dust Studies Simplified by Glycerine
Vol. 11, *No.* 2. *February*, 1939. *p.* 100
Simple method of making dust counts consists of exposing glass slides smeared with glycerine gelatine; how to make the glycerine gelatine jelly.

Edison Electric Institute Reports Number and Horsepower of Air Conditioning Installations
Vol. 11, *No.* 11. *November*, 1939. *p.* 670
Summary of total air conditioning installations reported by 141 electric utility companies to the Edison Electric Institute as of March 31, 1939; number of installations and horsepower for the various residential, commercial and industrial applications; number and horsepower of self-contained conditioner installations.

Fire Hazards in Buildings
Vol. 11, *No.* 5. *May*, 1939. *p.* 292
Report of discussion on fire protection in buildings which have air conditioning or ventilating systems; insurance interests concerned with the problem; observe principle of subdivision to avoid impairing the integrity of fire stops; use of thermostats to shut down fans; automatic sprinklers; release of carbon dioxide; revisions in regulations of National Fire Protection Association.

Gas Fired Dehumidifier Used for Smoking Fish, by Harry W. Smith, Jr.
Vol. 11, *No.* 4. *April*, 1939. *p.* 232
Advantages of using dehumidified air in smoking fish; installation of silica gel unit at Mutual Smoked Fish Co., Paterson, N. J.; gas and electrical requirements; humidity control; air circulation.

Health of Office Workers Aided by Air Conditioning
Vol. 11, *No.* 9. *September*, 1939. *p.* 551
Air conditioning accomplishes a 28 per cent reduction in illnesses which cause an office employee to stay home from work, according to survey; attendance records of various offices; percentage reductions in employee absenteeism with air conditioning; savings of $600,000,000 per year estimated through extension of air conditioning to all workers.

Hotel Installs Air Conditioning
Vol. 11, *No.* 7. *July*, 1939. *p.* 440
Brief description of air conditioning units for guest rooms in Waldorf-Astoria hotel, New York, N. Y.; units installed in ceiling of room foyers; cold water circulated to units from central refrigeration plant; two speed switches and thermostats allow guests to adjust condition.

How Can We Lighten the Load of Air Conditioning Selling Costs?, by Lester T. Avery
Vol. 11, *No.* 9. *September*, 1939. *p.* 543
General discussion of how to reduce air conditioning selling expense without lessening promotion of air conditioning; growth and function of the consultant; opportunity for consulting engineers and engineers associated with architects to promote air conditioning; how the consultant can sell his services; air conditioning a specialized problem; consulting engineers central bureau or a contractors central survey bureau suggested.

How Storage Principle Is Applied in Air Conditioning an Office Building, by D. C. Pfeiffer
Vol. 11, *No.* 8. *August*, 1939. *p.* 489
Description of main office building of Dallas Power & Light Co., Dallas, Texas; original air conditioning installation; air conditioning extended to other floors; storage principle used; amount of storage; description and diagram of storage tank, refrigeration equipment and air conditioning equipment; normal day operation; night operation for cooling tank; night operation of building; elaborate installation of instruments and controls; how the control system operates; curves showing typical summer day heat load, typical summer day electic load, and typical October day electric load.

Installation and Servicing of Air Conditioning Jobs
Vol. 11, *No.* 7. *July*, 1939. *p.* 424
Abstract of paper presented by A. F. Avera at University of Texas air conditioning conference; cost estimates should be broken down so bookkeeper can charge up job costs intelligently; what estimate sheet should include; practical pointers on installation and servicing.

It Pays to Keep Cool, by Paul G. Heidman
Vol. 11, *No.* 10. *October*, 1939. *p.* 616
Study of dollar-and-cents value of air conditioning in an office made in the drafting and surveying bureau of the Detroit Edison Co.; study shows increase in efficiency of 5.4 per cent; other advantages of air conditioning an office; preventing tracing cloth from changing in dimension; humidity control improves operation of addressing and billing machines; total operating and maintenance cost for building lower because of air conditioning; air conditioning made possible an economical solid block design of the building; rate of dust accumulation in air conditioned building approximately one-fourth that in general office building which is not air conditioned.

Knowledge of All Conditions Essential
Vol. 11, *No.* 4. *April*, 1939. *p.* 239
Importance of complete knowledge of all factors when wells are being used for supplying or disposing of water as cited by W. D. Gerber.

Kraft Cheese Has New Air Conditioned Headquarters
Vol. 11, *No.* 10. *October*, 1939. *p.* 618
Description in pictures of new world headquarters building of Kraft-Phenix Cheese Corp., Chicago, Ill.; building houses executive and general offices, research laboratories, and manufacturing units; ammonia compressors; cooling tower; central station systems and units; control; static pressure regulator; combined lighting and air outlet fixtures; wrought iron pipe and stainless steel tubing used.

Lease Forms for Air Conditioning
Vol. 11, *No.* 11. *November*, 1939. *p.* 694
Air conditioning clauses used in lease forms of various air conditioned buildings; some buildings set up expense of service in regular rental schedule, the same as heating expense is covered.

Library "Treasure Room" Air Conditioned, by Harold S. Birkett
Vol. 11, *No.* 9. *September*, 1939. *p.* 558
Air conditioning to be used to preserve rare manuscripts and valuable books at new Central Public Library, Brooklyn, N. Y.; room air to be maintained at constant humidity with gas fired silica gel equipment.

Lithographing Plants Need Air Conditioning
Vol. 11, *No.* 11. *November*, 1939. *p.* 680
Brief summary of address made by E. H. Dafter before National Association of Photo-Lithographers; three places in modern lithographing plants where control of atmospheric conditions is important.

Maps Aid Air Conditioning Development, by William P. Rock and Knight C. Porter
Vol. 11, *No.* 6. *June*, 1939. *p.* 364
Maps of outlying commercial districts in Chicago show air conditioned and non-air conditioned establishments; valuable in promotion and sales activities; 18 such centers to be mapped.

Men and Metal Both Air Conditioned in New Plant of the Carboloy Company, by K. G. Patrick
Vol. 11, *No.* 11. *November*, 1939. *p.* 681
Air conditioning used at new building of Carboloy Co., Detroit, Mich., to keep employees comfortable and powdered metal stocks carefully controlled for mixing; system broken down into three zones; separate conditioner for basement containing recreation room and cafeteria; powder metal department reached through air locks to insure uniform operation of air conditioning system; control of dehumidifying process centers about small telechron driven relay which checks both temperature and humidity every minute; special provisions made for water and metal salvage.

Modern Illumination Presents Problems for Air Conditioning Design to Solve, by Samuel R. Lewis
Vol. 11, *No.* 3. *March*, 1939. *p.* 145
(Paper presented at meeting of Chicago chapter of Illuminating Engineering Society); importance of allowing for heat from illumination in air conditioning design; increased lighting increases air conditioning load; lighting affects heat control; two air systems recommended for intensely lighted rooms, one for removing heat from lights; examples where lighting affected cooling load and air distribution; how various difficulties were solved; location of air outlets with relation to lighting fixtures; recommended air distribution scheme for an art gallery; automatic control of lights.

Modern Lighting and Air Conditioning
Vol. 11, *No.* 12. *December*, 1939. *p.* 746
Three illustrations showing relation of air diffusers and modern lighting in reception room and general offices of Pepsodent Co., Chicago, and Three Sisters store, Chicago; edge of diffuser turned up to conceal lights; lights concealed around edge of ceiling coffer; Bank of Madison installation.

National Gallery of Art To Be Air Conditioned
Vol. 11, *No.* 3. *March*, 1939. *p.* 165
New National Gallery of Art in Washington, D. C. to be air conditioned; air conditioning benefits art galleries or museums by providing comfort for staff and visitors and preserving art objects; ill effects of low humidities in winter; prevention of "bronze disease"; eliminating "bloom" from surface of oil paintings; keeping out dust and correcting acid content of air; experience of Frick museum, New York City.

NFPA Revises Its Regulations for Air Conditioning Systems
Vol. 11, *No.* 6. *June*, 1939. *p.* 375
Revisions of its Regulations for Air Conditioning and Blower Systems, 1938 edition, adopted by National Fire Protection Association; construction of ducts; automatic fire doors and dampers; air intakes and outlets; air filters; controls; air cooling and heating equipment; section on maintenance of air conditioning systems adopted; fresh air intakes; inspection and cleaning of ducts and plenum chambers; filters; fans, fan

motors and controls; fire doors and fire dampers; repair work; inspection form.

Office Building Has Diesel Power Plant
Vol. 11, *No.* 3. *March*, 1939. *p.* 170
Alfred I. du Pont building, Miami, Fla., said to be largest office building to depend entirely on diesel power; engines are electrically started; diesel and air conditioning equipment situated in soundproof room.

Packard Offers Automobile Air Conditioning System
Vol. 11, *No.* 12. *December*, 1939. *p.* 756
Brief description and diagram of automobile air conditioning system announced for Packard cars.

Performance of Coils for Dehumidifying Air, by William Goodman
Vol. 11, *No.* 1. *January*, 1939. *p.* 13
(Part 3); boundary dry bulb temperature; method of determining whether there will be any dry surface on a direct expansion coil; change in temperature and enthalpy of air as it flows over a direct expansion coil that is partly dry; area of wetted surface required for a counterflow coil; final wet bulb temperature of air leaving wetted surface of counterflow coil; final dry bulb temperature of air leaving a counterflow coil; boundary dry buib temperature for counterflow coils; surface temperature in counterflow coils; diagram showing change in enthalpy and temperature of air and refrigerant flowing through counterflow coils for various conditions. (See correction for Fig. 11 in April, 1939, issue).

Performance of Coils for Dehumidifying Air, by William Goodman
Vol. 11, *No.* 2. *February*, 1939. *p.* 83
(Part 4); relationship between condition curve presented in this series of articles and the dehumidification process usually described in text books; limiting conditions and psychrometric chart illustrating them; determining film coefficients by test; diagram of test set-up for determining coil performance; equation for determining whether or not frost will form on coil; Appendices 1 and 2 showing derivation of equations given in text.

Performance of Coils for Dehumidifying Air, by William Goodman
Vol. 11, *No.* 3. *March*, 1939. *p.* 157
(Part 5); appendices showing the development of equations given in text and method of computing values presented in Table 1 of text; construction of Fig. 3.

Performance of Coils for Dehumidifying Air, by William Goodman
Vol. 11, *No.* 4. *April*, 1939. *p.* 233
(Part 6); appendices 8, 9, 10, 11, 12, 13 and 14 giving derivations of equations used in text, and information on the condition curve.

Performance of Coils for Dehumidifying Air, by William Goodman
Vol. 11, *No.* 5. *May*, 1939. *p.* 305
(Part 7); tests on direct expansion and counterflow water coils; test data; analysis of the tests; air film and water film coefficients.

Physicians Report Benefits of Air Conditioning
Vol. 11, *No.* 12. *December*, 1939. *p.* 752
Brief report of survey made by magazine Medical Economics on benefits of air conditioning of physician's offices.

Portable Air Conditioner Installed on Ship
Vol. 11, *No.* 1. *January*, 1939. *p.* 35
Brief report on installation of portable air conditioner on Dutch ship; description of installation.

Power Savings Through Static Pressure Regain in Air Ducts, by J. R. Fellows
Vol. 11, *No.* 4. *April*, 1939. *p.* 219
How static pressure regain may be applied to reduce fan power requirements; static pressure regain applied to a simple fan and duct; regain in an abruptly expanded section; regain in a gradually expanded section; two arrangements for static pressure regain with recommendations for practical application; effect on power requirements; curves showing theoretical velocity pressure conversion, pressure losses, efficiency for abrupt expansion, ratio of actual loss in diverging sections to Borda loss, static pressure regain for diverging sections in circular ducts, and observed static pressures in duct with diverging sections; sketch showing expanding sections with after sections for effecting static pressure regain.

Properties of Air-Vapor Mixtures Interpolated to Tenths of a Degree, by William Goodman
Vol. 11, *No.* 1. *January*, 1939. *p.* 35
Table of absolute humidity and enthalpy of mixtures of air and saturated water vapor interpolated to tenths of a degree for temperatures from minus 20 to minus 3.1 F; explanation of use.

Properties of Air-Vapor Mixtures Interpolated to Tenths of a Degree, by William Goodman
Vol. 11, *No.* 2. *February*, 1939. *p.* 86
Table of absolute humidity and enthalpy of mixtures of air and saturated water vapor interpolated to tenths of a degree for temperatures from minus 3 to plus 30.9 F; explanation of use.

Properties of Air-Vapor Mixtures Interpolated to Tenths of a Degree, by William Goodman
Vol. 11, *No.* 3. *March*, 1939. *p.* 160
Table of absolute humidity and enthalpy of mixtures of air and saturated water vapor interpolated to tenths of a degree for temperatures from 31.0 to 64.9 F; explanation of use.

Properties of Air-Vapor Mixtures Interpolated to Tenths of a Degree, by William Goodman
Vol. 11, *No.* 4. *April*, 1939. *p.* 236
Table of absolute enthalpy of mixtures of air and saturated water vapor interpolated to tenths of a degree for temperatures from 65.0 to 100.0; explanation of use.

Properties of Mixtures of Air and Saturated Water Vapor for Barometric Pressures from 22 In. to 32 In. of Mercury, by William Goodman
Vol. 11, *No.* 7. *July*, 1939. *p.* 445
Table of properties of mixtures of air and saturated water vapor for 22 in. barometric pressure and for a temperature range from —40 F to +200 F; explanation of table and example showing use.

Properties of Mixtures of Air and Saturated Water Vapor for Barometric Pressures from 22 In. to 32 In. of Mercury, by William Goodman
Vol. 11, *No.* 8. *August*, 1939. *p.* 505
Table of properties of mixtures of air and saturated water vapor for 23 in. barometric pressure and for a temperature range from —40 F to + 200 F.

Properties of Mixtures of Air and Saturated Water Vapor for Barometric Pressures from 22 In. to 32 In. of Mercury, by William Goodman
Vol. 11, *No.* 9. *September*, 1939. *p.* 567
Table of properties of mixtures of air and saturated water vapor for 24 in. barometric pressure and for a temperature range from —40 F to + 200 F.

Properties of Mixtures of Air and Saturated Water Vapor for Barometric Pressures from 22 In. to 32 In. of Mercury, by William Goodman
Vol. 11, *No.* 10. *October*, 1939. *p.* 627
Table of properties of mixtures of air and saturated water vapor for 25 in. barometric pressure and for a temperature range from —40 F to + 200 F.

Properties of Mixtures of Air and Saturated Water Vapor for Barometric Pressures from 22 In. to 32 In. of Mercury, by William Goodman
Vol. 11, *No.* 11. *November*, 1939. *p.* 689
Table of properties of mixtures of air and saturated water vapor for 26 in. barometric pressure and for a temperature range from —40 F to + 200 F.

Properties of Mixtures of Air and Saturated Water Vapor for Barometric Pressures from 22 In. to 32 In. of Mercury, by William Goodman
Vol. 11, *No.* 12. *December*, 1939. *p.* 755
Table of properties of mixtures of air and saturated water vapor for 27 in. barometric pressure and for a temperature range from —40F to +200 F.

Psychrometric Chart—Its Application and Theory, The, by William Goodman
Vol. 11, *No.* 6. *June*, 1939. *p.* 357
(Part 1); new chart plotted with enthalpy (total heat) as abscissa and absolute humidity as ordinate; advantages of such a chart; several saturation curves for various barometric pressures; method of reading dew point temperatures; moisture ratio; features of chart; chart for temperature range from 20 to 120 F.

Psychrometric Chart—Its Application and Theory, The, by William Goodman
Vol. 11, *No.* 7. *July*, 1939. *p.* 421
(Part 2); method of using ratio lines; measurement of ratio angles; table of ratio angles for various values of moisture ratio; examples.

Psychrometric Chart—Its Application and Theory, The, by William Goodman
Vol. 11, *No.* 8. *August*, 1939. *p.* 485
(Part 3); explanation of the sensible heat ratio and the moisture ratio; advantages of using the moisture ratio; formulas; the energy equation and what it is; mixtures of air and water; example showing use of formulas; chart showing ratio lines corresponding to water at 32 deg and 212 deg.

Psychrometric Chart—Its Application and Theory, The, by William Goodman
Vol. 11, *No.* 9. *September*, 1939. *p.* 549
(Part 4); discussion of wet bulb temperature; psychrometric charts show lines of constant temperature of adiabatic saturation; line of constant temperature of adiabatic saturation on psychrometric chart; wet bulb temperature depends upon velocity of air; formula for drawing lines on chart; determining wet bulb temperature of a point not on the saturation curve.

Psychrometric Chart—Its Application and Theory, The, by William Goodman
Vol. 11. *No.* 10. *October*, 1939. *p.* 613
(Part 5); tables giving end points for plotting wet bulb lines on psychrometric chart; mixtures of air and steam; determining slope of dry bulb temperature line on chart; relative location of ratio lines on psychrometric chart for moisture in various forms.

Psychrometric Chart—Its Application and Theory, The, by William Goodman
Vol. 11, *No.* 11. *November*, 1939. *p.* 671
(Part 6); use of the area to the left of the saturation curve on the psychrometric chart, where any point represents a mixture of air, saturated steam, and free moisture—that is, fog; method of reading temperature of fogged air; illustration; weight of moisture mixed with the air; how air is fogged by addition of steam; example showing that total quantity of heat surrendered by the steam is equal to the heat gained by the air when the two are mixed; methods of keeping rooms clear of fog; psychrometric chart showing path of state point when fogged air is cleared either by heating or by mechanical separation.

Psychrometric Chart—Its Application and Theory, The, by William Goodman
Vol. 11, *No.* 12. *December*, 1939. *p.* 749
(Part 7); conditions below freezing; pyschrometric charts for temperatures from 0 to 450 F, and for minus 20 to plus 40 F; use of low temperature range chart; examples; subcooled water; ice on wet bulb; mixtures of air, saturated vapor and snow.

Refrigerating Engineers Hear Papers on Air Conditioning
Vol. 11, *No.* 7. *July*, 1939. *p.* 438
Brief review of papers presented at spring meeting of American Society of Refrigerating Engineers, Hershey, Pa.; bus air

conditioning; air conditioning in government buildings; thermodynamic properties of methyl chloride; refrigeration applications at Hershey Chocolate Corp. plant.

Resistance of Materials to Vapor Transmission
Vol. 11, *No.* 4. *April,* 1939. *p.* 213
Table presented by L. V. Teesdale showing comparative resistance of various materials to vapor transmission.

Restaurants Store Refrigerating Effect for Use During Peak Conditioning Loads, by Lester T. Avery
Vol. 11, *No.* 2. *February,* 1939. *p.* 95
Change-over of ice-using cooling installations to mechanical compressor jobs arranged to store refrigerating effect for use during periods of peak air conditioning loads by freezing ice on coils; reasons for making the changes; diagram of the storage system; control; change in compressor capacity as suction temperature drops due to freezing of ice on coils; practical points to consider in design of storage refrigeration systems.

Rockefeller Center Adds Refrigeration for Increasing Air Conditioning Load, by C. W. Walton, Jr.
Vol. 11, *No.* 6. *June,* 1939. *p.* 369
Eight hundred ton centrifugal refrigerating machine added to original installation of three 300 ton machines at Rockefeller Center, New York, N. Y.; the original and revised chilled water cycles and piping systems; low pressure, intermediate pressure and high pressure systems; further additions contemplated.

Some Fundamentals of Psychrometry, by Serge J. Zaroodny
Vol. 11, *No.* 5. *May,* 1939. *p.* 294
Review of fundamentals of psychrometry with a comparison of the dew point and adiabatic saturation methods and with a distinction between the adiabatic saturation and wet bulb temperatures; chart showing wet bulb and adiabatic saturation temperatures; liquids other than water.

Some Legal Aspects of Air Conditioning, by Lawrence R. Bloomenthal
Vol. 11, *No.* 5. *May,* 1939. *p.* 301
Some of the legal complications that may arise in design and installation of air conditioning systems; mistakes in bidding; delays in completion; defective plans; recommendations of material; dissatisfaction with completed job; guarantees and warranties; examples.

Static Electricity in Blower Systems
Vol. 11, *No.* 8. *August,* 1939. *p.* 484
Brief description of bulletin of Underwriters' Laboratories, Inc. on generation of static electricity in blower systems; voltages observed in systems handling dust or lint; static charge increases with increase in concentration of dust or lint, fineness of particles, velocity of air stream and decrease in humidity; grounding systems to prevent accumulation of charges.

Static Electricity in Sawdust Duct Eliminated by Use of Water Sprays, by Alf H. Hofberg
Vol. 11, *No.* 8. *August,* 1939. *p.* 484
Static electricity hazard in sawdust conveying system eliminated by spraying water into duct; method of reading voltages with electrostatic voltmeter; effect of humidity on charge; method of introducing moisture into duct; use of gold leaf electroscope for showing whether or not a charge exists.

Survey Shows 11,676 Railway Cars Air Conditioned at Close of 1938
Vol. 11, *No.* 5. *May,* 1939. *p.* 292
Tabulation giving summary of railway cars air conditioned in 1938 and a nine year summary of air conditioned railway cars by railroad, type of car, type of system and refrigerant used.

Temperature Study Shows Value of Flooding Roof to Reduce Heat Gain, by R. A. Rothschild
Vol. 11, *No.* 7. *July,* 1939. *p.* 441
Flooded roof on Alabama highway department office building in Montgomery; temperature studies made to show advantage in reducing solar heat gain; method of making studies; test results plotted.

Tenant Reaction to Air Conditioning, by J. W. Stiles
Vol. 11, *No.* 5. *May,* 1939. *p.* 283
Second National Bank Building, Houston, Texas, modernized by air conditioning; not a question of competition; principal features of the air conditioning plant, the zoning and the duct system; how air conditioning was announced to the tenants; reaction to announcement; air conditioning sells itself to tenants; examples; conditions maintained; office building air conditioning here to stay; importance of attractive duct layout.

Ten Years Progress in Air Conditioning, by Walter L. Fleisher
Vol. 11, *No.* 7. *July,* 1939. *p.* 428
Developments in air conditioning during past 10 years; comfort air conditioning now predominates; importance of air conditioning to comfort and health; billion dollar industry; coöperation between engineers, contractors, manufacturers and architects to avoid promotion of inadequate equipment and the misapplication of good equipment essential.

Texas A & M Holds Air Conditioning Short Course
Vol. 11, *No.* 9. *September,* 1939. *p.* 546
Brief report of first annual air conditioning short course at Agricultural and Mechanical College of Texas, College Station, Texas; John Howatt speaks on duties, responsibilities and opportunities of engineers; research as related to air conditioning reviewed by Dr. F. E. Giesecke; other speakers and their subjects.

Theory Needs Common Sense for Reasonable Engineering, by Lester T. Avery
Vol. 11, *No.* 12. *December,* 1939. *p.* 744
Importance of checking engineering results to be sure they are reasonable; examples of air conditioning calculations that need revision when common sense supplements theory; importance of engineer in comfort air conditioning; competitive specifications; is the customer always right?; some causes of complaints about air conditioning; practical development of air conditioning is in the hands of the designing engineer.

What Did Air Conditioning Do in an "Off Year"?, by Knight Porter and William Rock
Vol. 11, *No.* 1. *January,* 1939. *p.* 32
Analysis of air conditioning installations in Chicago during 1938; decrease as compared with 1937; decrease for competitive installations less than for non-competitive installations; tables showing number of installations and horsepower for 1937 and 1938 for competitive and non-competitive types of installations; authors conclude that where motive for buying air conditioning is profit and local competition, volume holds up well despite poor general business conditions; where buying motive is largely comfort and efficiency, general business conditions have more effect and investment in air conditioning is postponed.

What to Consider When Using Wells, by E. W. Bennison
Vol. 11, *No.* 4. *April,* 1939. *p.* 227
How wells are classified; effect of well diameter on capacity; proper type of and material for well screen is important; methods of increasing capacity of wells; how a well functions; relationship between drawdown and yield; definition of an artesian well; temperature of ground water; reclaiming failed wells.

General

Consulting Engineer in Modern Construction, The
Vol. 11, *No.* 6. *June,* 1939. *p.* 367
Report of discussion at annual dinner meeting of consulting engineers' division of Western Society of Engineers; importance of conclusive engineering analysis; qualifications of consulting engineers in heating and air conditioning field.

Directory Section of Heating, Piping and Air Conditioning Equipment for Industry and Large Buildings
Vol. 11, *No.* 1. *January,* 1939. *p.* 167 (*back section*)
Products classified, trade names and complete street addresses of manufacturers.

Handy Measuring Kink, A, by W. F. Schaphorst
Vol. 11, *No.* 10. *October,* 1939. *p.* 612
Method of making accurate measurements between two walls or objects which cannot be measured directly.

Long-Range Weather Forecasting—Its Present Status and Future Possibilities, by I. I. Schell
Vol. 11, *No.* 5. *May,* 1939. *p.* 285
Difficulties of long-range weather forecasting; basis for forecasts; correlation coefficient; oscillations and relationships between seasonal weather; difference between actual and forecast weather; examples of results which have been achieved; maps showing effect on storm tracks of light ice and heavy ice conditions.

Heating

Attention to Heating Plant Now Will Pay Dividends Next Winter, by Lewis W. Mauger
Vol. 11, *No.* 7. *July,* 1939. *p.* 413
Importance of proper attention to heating plant during the summer; cleaning heating boilers; soot blowers; protecting against corrosion on water side and fire side; water treatment; removal of scale; inspection of heating equipment; maintenance of stokers and oil burners; controls and insulation; checking steam circulation in system; general maintenance rules; instructions for treatment of boilers during non-heating season and care and upkeep of heating plants; form for building heating report.

Building Designed by Frank Lloyd Wright Features Floor Heating, Air Conditioning, by Victor Walters
Vol. 11, *No.* 11. *November,* 1939. *p.* 661
Description of office building for S. C. Johnson & Son, Inc., Racine, Wis.; cork insulation for walls and roof; windowless construction; welded wrought iron pipe coils in floor; subatmospheric steam from power plant for heating; five control zones; air conditioning specifications; duct work built in; condensing units; performance of system, owner's comments on advantage of air conditioning.

Combustion Space and Setting Height for Stoker Fired Boilers Is Studied
Vol. 11, *No.* 11. *November,* 1939. *p.* 687
Information from field survey on the relation of combustion space and setting height to smoke when firing bituminous coal with underfeed stokers; significance of the data obtained in general survey of 102 installations and experimental survey of 22 installations; discussion of what causes smoke; illustration of smoke sampler used in tests; conclusions of survey.

Correcting Defective Heating Systems, by O. E. Stossel
Vol. 11, *No.* 2. *February,* 1939. *p.* 101
Lack of funds made thorough overhauling of vacuum heating systems in two hotels impossible; stopping leaks; correcting leaking traps; pockets in piping; correcting excessive condensation in piping; installation of priming pipe for vacuum pump.

Corrosion in Steam Heating Systems, by Leo F. Collins with Everette L. Henderson
Vol. 11, *No.* 9. *September,* 1939. *p.* 539
(Part 1); study of various aspects of the subject based upon 15 years of research work for the Detroit Edison Co.; data obtained in plants of Detroit Edison Co. or in Detroit buildings; general conclusions; scope of the research work; scheme of presentation; occurrence of corrosion in operating steam heating systems; arrangement of rudimentary heating systems; the corrosion measurements; NDHA corrosion tester; analysis of deposits taken from heating equipment; chart showing corrosion rates as determined at 39 different locations in 23 buildings.

Corrosion in Steam Heating Systems, by Leo F. Collins with Everette L. Henderson
Vol. 11, *No.* 10. *October,* 1939. *p.* 620
(Part 2); dissolved gases the basic causes for corrosion; measurement of influence of entrained gases; a new theory of heating system corrosion; diagram showing arrangement of apparatus to measure corrosion produced by entrained gases

a[illegible]e; curves showing relation between corrosion and gas content of condensate when varying quantities of condensate are flowing; curves showing CO_2-pH relationships of condensates "buffered" to different degrees.

Corrosion in Steam Heating Systems, by Leo F. Collins with Everette L. Henderson
Vol. 11, *No.* 11. *November*, 1939. *p.* 675
(Part 3); theory of heating system corrosion propounded in Part 2 demonstrated by experimental and operating data; experimental data plotted showing increase in pH value and decrease in corrosiveness of condensate as function of progressive contact with iron surfaces; amount of metal dissolved from bottom of horizontal return line at varying distances from condensing equipment in a building; corrosion rates and analyses of condensate as function of amount of steam bled from vapor space of water heater; effects of system design and operation; pH value of condensates and corrosion rates found in main return lines of operating systems; amount of CO_2 measured in vapor space of water heater at various condensation rates.

Corrosion in Steam Heating Systems, by Leo F. Collins with Everette L. Henderson
Vol. 11, *No.* 12. *December*, 1939. *p.* 735
(Part 4); methods of reducing corrosion troubles; expedients studied; freeing plugged pipes with chemical solvent; vacuum cleaning radiators; apparatus and results; studies with inhibitors; use of ammonia, oil, and sodium silicate; effect of pressure, vacuum and intermittent operation of heating system; importance of tight joints in piping, valves, etc.

Department Store Warehouse Heating Requirements Outlined by Specialist, by O. L. Merkt
Vol. 11, *No.* 9. *September*, 1939. *p.* 552
Functions and departments of a department store warehouse; construction; inside temperature; use of unit heaters; ventilating; piping layout; boilers; incinerator; selection of fuel; advantage of instruments; description of new Woodward & Lothrop warehouse, Washington, D. C.; unit heaters and their control; ventilation; stoker fired boilers; process steam; instruments and smoke alarm.

Designing Hot Water Heating Systems, by Erwin L. Weber
Vol. 11, *No.* 2. *February*, 1939. *p.* 79
Notes on the piping layout; temperature drop; friction head; velocities; estimating equivalent length of circuit; factors for figuring equivalent length for reducing tees; chart showing relation between total Btu per hr, pipe sizes, water velocities and frictional resistance; tabular design data for 20 F temperature drop and transmission rate of 240 Btu per sq ft per hr; step-by-step example showing use of data.

Diesel Engines to Heat Snow Cruiser
Vol. 11, *No.* 11. *November*, 1939. *p.* 674
Brief description and illustration of snow cruiser developed by research foundation of Armour Institute of Technology for Antarctic expedition; radiator cooling system of diesel engines to furnish heating.

Direct Fired Air Heaters Meet Requirements of Aircraft Plant, by H. E. Ziel
Vol. 11, *No.* 5. *May*, 1939. *p.* 299
Method of heating aircraft assembly plant of Glenn L. Martin Co., Baltimore, Md.; general limitations on heating system; direct fired air heaters with oil burners meet requirements; circulation and diffusion of air; disposal of products of combustion; control; illustrations of the building and the heating equipment.

Fuel Consumption Estimating Formulas Given in Housing Authority Bulletin
Vol. 11, *No.* 9. *September*, 1939. *p.* 559
Fourth and concluding part of United States Housing Authority bulletin on heating of low rent housing projects comprises fuel consumption estimating formulas; steam heating; hot water heating; warm air heating; domestic water heating; district heating; fuel factor tables for coal, oil, gas and district steam; origin of constant used in formulas of 96 Btu per sq ft of steam radiation per degree day; examples showing use of formulas; example for degree day tabulation.

Fuel Consumption Record Forms Help to Promote Heating Economy, by Lewis W. Mauger
Vol. 11, *No.* 12. *December*, 1939. *p.* 753
Importance of records to intelligent supervision of building heating plants; record forms and reports used by a building management company; items included in annual heating report; fuel consumption data for apartment, office and loft buildings; pounds of fuel per 1000 cu ft per degree day for buildings.

Gasification of Coal
Vol. 11, *No.* 8. *August*, 1939. *p.* 503
Possibilities of using high pressures to obtain a gas of high calorific value without the use of oil for enrichment discussed in technical report of Bituminous Coal Research, Inc.; need for research.

Heat Barriers Classified
Vol. 11, *No.* 4. *April*, 1939. *p.* 214
Scale for arbitrarily classifying heat barriers as given by S. Konzo.

Heating and Air Conditioning Engineer Reviews His Ten-Year-Old Predictions, by Samuel R. Lewis
Vol. 11, *No.* 5. *May*, 1939. *p.* 281
Review of predictions made in article published in May, 1929, HPAC; coöperative apartment buildings; slum clearance projects; difficulties in controlling the heating in individual apartments; spreader and underfeed stokers; oil burners; gas burning systems; use of vacuum and hot water heating; welding and sweating piping joints; the term "square foot of radiation" becoming obsolete; the Mb and Mbh units; insulation; refrigerants; wider use of evaporative condensers and cooling towers; ventilation air requirements; control; use of turbine drives in air conditioning; the trend in marketing air conditioning; the 1939 heating and air conditioning engineer.

Heating and Air Conditioning Pittsburgh's Buhl Planetarium, by George S. McEllroy and Theodore F. Rockwell
Vol. 11, *No.* 6. *June*, 1939. *p.* 345
Description of the new Buhl Planetarium and Institute of Popular Science, Pittsburgh, Pa.; size and uses; factors influencing heating design; heat losses in Mbh and Btu per hr per cu ft; division of load; analysis of cooling loads; summer, winter and design cfm; fan capacities; analysis indicating advisability of storing refrigerating effect; deep well water for precooling; two 20 ton compressors; chilled water and well water cycles; control of cooling system; air distribution; preventing condensation on perforated dome of planetarium chamber.

Heating and Cooling Engineer Talks About Some Troubles, by Samuel R. Lewis
Vol. 11, *No.* 1. *January*, 1939. *p.* 25
Troubles with various heating and cooling installations and what the author would do differently in the light of these experiences; accessibility of equipment; use of sweated copper joints; importance of valves to isolate leaks; draining finned copper convectors; corrosion of condensers; troubles due to increased occupancy of air conditioned areas; difficulties in handling air; need for exhaust fans and dampers to keep a definite relation between area of outside air intake, outboard exhaust and recirculation; use of duct reheaters; forced circulation hot water heating systems; secondary air filters; miscellaneous comments on valves and dampers, antifreeze mixtures, compressors, finned tube convectors, trapping, and fans.

Heating and Ventilation on Treasure Island, by William E. Leland
Vol. 11, *No.* 4. *April*, 1939. *p.* 226
Brief description of heating and ventilating of buildings at Golden Gate International Exposition on Treasure Island in San Francisco Bay; administration building has forced hot water system fired by oil; some buildings heated by gas; water curtain for outdoor stage.

Heating Practices of Consulting Engineers, The, by Samuel R. Lewis
Vol. 11, *No.* 8. *August*, 1939. *p.* 502
Practice of engineering is seeking the truth; the tools of the consulting engineer; recommendations depend upon the situation; forced hot water heating from central plant used at a state university; use of gas burning boilers and unit heaters in buildings below flood water level; advantages of insulating building to reduce heating costs.

Heating the World's Largest Apartment Project, by Henry G. Schaefer
Vol. 11, *No.* 4. *April*, 1939. *p.* 211
General description of apartment housing project of Metropolitan Life Insurance Co., New York City; importance of wall insulation; sub-atmospheric steam for heating; newly developed "one pipe," looped, valveless enclosed convector heating system; diagram of piping; method of temperature control; boiler plant oil fired but can be converted to pulverized coal; plant designed for high pressure operation if electrical generation becomes advisable.

How a Pioneer Skyscraper Has Obtained Heat Economy, by Rex E. Hieronymus
Vol. 11, *No.* 3. *March*, 1939. *p.* 149
How the heating system of the Monadnock building, Chicago, built in 1892-93, was modernized; heating system has four zones; exhaust steam formerly furnished from hydraulic elevators; new boilers installed; two avenues of heating economy —steam generation and steam utilization; determining building temperatures with portable recording thermometers; description and illustrations of heat switching machine for turning on and off the zone valves; how the switching mechanism is used; conditions in the heating system; results of the program and chart showing decrease in steam per degree day and decrease in cost of heating. (Also see p. 428, July issue).

How Are These Combustion Problems Solved?, by Kalman Steiner
Vol. 11, *No.* 4. *April*, 1939. *p.* 225
(Answers to a reader's questions); effect of amount of moisture in coal on water vapor in the flue gases; step by step explanatory calculation; amount of heat liberated per lb of carbon in complete combustion to CO_2 and in combustion to CO; typical values.

How to Plan an Operating Schedule for Heating and Air Conditioning, by Charles N. Bailey
Vol. 11, *No.* 10. *October*, 1939. *p.* 601
Description of operating schedule and chart for year 'round air conditioning system in store and office building; scheme can be applied to any plant serving more than one air conditioned space; method of determining schedules can be applied to any plant; brief description of air conditioning system; cut-off dampers promote economy; local temperature control units; use of portable temperature and humidity recorder; duct layout changed to prevent exhausting outside air from preheat chamber when air filters become dirty; manual and automatic control; the operating schedule and its use; charts supplement the schedule; illustrated operator's manual and its advantages; operating results show value of scheme described; unit cost for air conditioning; wet bulb temperature readings determine use of outside air.

Importance and Attainment of Smokeless Boiler Plant Operation, The, by J. F. Barkley
Vol. 11, *No.* 11. *November*, 1939. *p.* 691
Importance to the individual owner of smokeless combustion; cause of smoke; chief cause of smoke production in ordinary plant is the way it is operated; eliminating smoky operation; use of smoke indicating devices; use of steam-air jets; diagram showing installation of steam-air jets.

Install a Booster Pump on Hot Water Heating System?, by Samuel R. Lewis
Vol. 11, *No.* 11. *November*, 1939. *p.* 694
(Answer to a reader's question); advantages of converting gravity hot water heating systems to forced circulation.

Installation of Incinerator in Oil Fired Boiler, by Kalman Steiner
Vol. 11, *No.* 3. *March*, 1939. *p.* 160
(Answer to a reader's question); in design of a municipal clinic, consideration being given to steel oil fired boiler arranged for rear firing with incinerator built into front of

boiler; opinion on suitability asked; front firing of boiler recommended; incorporate incinerator within boiler walls.

Methods of Establishing k Values—How Heat Conductivities Have Been Determined, by Kalman Steiner and Sydney D. Black
Vol. 11, *No.* 5. *May*, 1939. *p.* 290
The story back of the tables of conductivity values used by heating, piping and air-conditioning engineers; laboratory experiments made on simple geometric forms—rods, hollow cylinders, plates, spheres, and prisms; use of rods; cylinder method; diagrams.

Novel Scheme Employed for the Support of Heating Coil Units, by H. E. Ziel
Vol. 11, *No.* 1. *January*, 1939. *p.* 30
Forced hot water heating system at Plymouth Motor Car Co., plant, Detroit, Mich.; additional heating surface installed in penthouses; loads imposed on building columns as roof trusses were overloaded; details showing methods of supporting heating equipment; load of fan and heater located eccentrically to create upward force on overloaded truss.

Organized Maintenance Procedure Cuts Fuel Consumption for School Heating (an interview with John Howatt)
Vol. 11, *No.* 1. *January*, 1939. *p.* 9
Types and capacities of boiler plants for Chicago schools; records; use of records; how maintenance is organized; boiler plant work done in summer; coal consumption in tons for heating 1000 sq ft of floor area for high school buildings and elementary school buildings for past six years; coal consumption on degree day basis.

Planning an Operating Schedule to Save Building Heating Steam, by Charles N. Bailey
Vol. 11, *No.* 6. *June*, 1939. *p.* 373
Building heating plant should be operated according to the weather instead of the calendar; launching heat economy program; obtaining temperature records with portable recording thermometers. and their use; determining starting up and shutting off times; temperature charts showing results achieved in one case by scheduling starting and stopping time for heating; checking up heating system for immediate repairs; controlling the steam.

Power Conference Discusses Air Pollution
Vol. 11, *No.* 5. *May*, 1939. *p.* 287
Brief report of discussion by Dr. R. V. Kleinschmidt at Midwest Power Conference; we have had an air pollution problem by products of combustion ever since man first used fire; causes of problem; development of wet type collector described.

Preparing Contract Documents for Low Rent Housing Projects
Vol. 11, *No.* 8. *August*, 1939. *p.* 495
Third part of United States Housing Authority bulletin on heating of low rent housing projects covers preparing the contract documents; the working drawings; materials; specifications; outline of a typical specification; steam space heaters; system of heating controls; requirements for all types of systems.

Rating of Heat Transmitters
Vol. 11, *No.* 7. *July*, 1939. *p.* 424
Comment on article by Samuel R. Lewis in May 1939 HPAC; rating of heat transmitter according to heat delivered by it rather than heat input to it; proposed method.

Regular Supervision of Apartment Hotel Heating Plants Cuts Costs, by Kalman Steiner
Vol. 11, *No.* 7. *July*, 1939. *p.* 425
Data on fuel consumption of group of large residential buildings in Chicago using oil; supervisory service; monthly call by service engineer; analysis of fuel consumption; comparison of three heating seasons; percentage savings through supervision; charts for two of the buildings showing gallons of fuel oil per degree day plotted against degree days per month; table of fuel consumption and gallons used per degree day; other savings by supervision.

Reverse Cycle System Heats or Cools Building
Vol. 11, *No.* 4. *April*, 1939. *p.* 218
Brief description of Westinghouse Electric & Mfg. Co. building at Emeryville, Calif., which has reverse cycle air conditioning system; estimated cooling and heating requirements; pick-up ratio of heat pump; electrical requirements.

Sales Development Keynotes Meeting of National District Heating Association
Vol. 11, *No.* 8. *August*, 1939. *p.* 483
Sales development the keynote of annual convention of National District Heating Association; report on study of heating economies; moving pictures of fuel beds under various conditions in boilers; highlights of 1938 given in operating statistics committee report; honorary members elected; new officers.

Selection of Heating Design Temperatures Is Analyzed in Carnegie Institute Bulletin
Vol. 11, *No.* 10. *October*, 1939. *p.* 622
Review of analysis of winter temperatures for 120 cities published in bulletin form by Carnegie Institute of Technology; analysis prepared by Clark M. Humphreys; conclusions of the study.

Smoke Preventers Hear Report on Field Survey of Stoker Plants
Vol. 11, *No.* 7. *July*, 1939. *p.* 442
Brief report of combustion space survey presented at Smoke Prevention Association meeting; purpose of survey; plants studied; results.

Steam Consumption for Humidifying
Vol. 11, *No.* 12. *December*, 1939. *p.* 752
Brief article on heat requirements for evaporating moisture for humidifying buildings, compared with requirements when there is no humidification.

Studies of Various Firing Equipment Included in Air Pollution Survey, by Frank A. Chambers
Vol. 11, *No.* 6. *June*, 1939. *p.* 368
Comprehensive air pollution survey of Chicago and vicinity by WPA sponsored by Armour Institute of Technology, Lewis Institute and the city; survey includes studies of visible smoke, dust and noxious gases, ultraviolet and visible light penetration through the atmosphere, abstracting scientific literature, and collection and codification of legal opinions and decisions; studies will be analyzed to show relationship of various firing equipment to air pollution, sources of contamination, fly ash, etc.

Study of Building Heating Economies Shows Money Value of Good Operation, by Earle Shultz and J. C. Butler
Vol. 11, *No.* 10. *October*, 1939. *p.* 609
Joint study made by National Association of Building Owners and Managers and National District Heating Association; questionnaire sent out to buildings; report covers steam for space heating only; heating steam consumption before and after application of heating economies for all the buildings answering the questionnaire; analysis of reports grouped by cities; analysis by source of steam supply, by type of building occupancy, and by type of heating system; tabulations show number of buildings, building volume, pounds of steam per degree day before and after heating economies, pounds of steam per degree day per 1000 cu ft before and after heating economies, and per cent savings due to heating economies; economical rate of steam consumption is 0.6 lb of steam per degree day per 1000 cu ft of building volume.

Study of Building Heating Economies Shows Money Value of Good Operation, by Earle Shultz and J. C. Butler
Vol. 11, *No.* 11. *November*, 1939. *p.* 667
The balance of the joint study made by the National Association of Building Owners and Managers and the National District Heating Association, the first part of which was presented in October, 1939; analysis of study by type of control systems installed: pounds of steam per degree day per 1000 cu ft of building volume for the various control systems; effect of building size and hours of heating on unit steam consumption; cost of control; heat saving methods without control apparatus; importance of records and meters; performance of controls; if off cycle is too long some difficulties are presented; general conclusions of the study; some advantages of purchasing steam.

Trouble With a Flue from a Heater, by Samuel R. Lewis
Vol. 11, *No.* 3. *March*, 1939. *p.* 156
(Answer to a reader's question); flue from small kerosene heater gives trouble because of a back draft; sketch of the flue; recommendations for correcting the trouble; insulation of the flue; use of an induced draft fan.

United States Housing Authority Releases Information on Heating
Vol. 11, *No.* 6. *June*, 1939. *p.* 361
Reprint of Part 1 of United States Housing Authority bulletin on heating of low rent housing projects, covering the economic analysis; objective; selecting heating method; factors affecting choice; types of systems; comparative cost analysis; forms for making analysis; form for estimating annual operating expense. (Also see p. 427, July issue).

USHA Gives Suggestions for Design of Heating Systems
Vol. 11, *No.* 7. *July*, 1939. *p.* 432
Recommendations and suggestions for design of heating plants prepared by United States Housing Authority; the central plant—boilers, steam outlets, cat walks, stacks, overhead bunkers, underground coal storage, coal handling equipment, ash handling equipment, instrument boards and instruments, draft control, test openings, feedwater heaters, condensate receiving tank, boiler feed pumps, pressure reducing valves; the group plant—piping, boiler feed pumps, steam outlets, motor truck scales; distribution lines; heating within the building; drying room heating.

Warm Air System Heats Giant Plane
Vol. 11, *No.* 3. *March*, 1939. *p.* 168
Brief description of 74 passenger Boeing 314 Clipper built for Pan American Airways; exhaust pipe stoves heat air; distribution of air to passenger spaces; carbon monoxide detector samples air; other protective devices; control of the heating system; thermostats; diagram of the heating and ventilating system.

Water Spray Ring Reduces Fly Ash, by Edward E. James
Vol. 11, *No.* 4. *April*, 1939. *p.* 240
Description of water spray ring installed in chimney at Cincinnati General Hospital to eliminate fly ash complaints; construction and erection of ring; diagram of installation; results of its use.

Piping

American Standard for Steel Pipe Flanges and Flanged Fittings (B16e-1939)
Vol. 11, *No.* 5. *May*, 1939. *p.* 289
Important changes in new edition of American Standard for Steel Pipe Flanges and Flanged Fittings, B16e-1939; effective date for applying the standards to new production.

ASME Speakers Present Data on Piping Design and Experience
Vol. 11, *No.* 3. *March*, 1939. *p.* 163
Abstracts of three papers presented at annual meeting of American Society of Mechanical Engineers; influence of metering equipment on piping; importance of ratio of diameter of nozzle or orifice plate to pipe diameter; location of nozzle or orifice plate for proper flow conditions; typical nozzle locations showing minimum lengths of straight pipe for undisturbed flow without straighteners; use of most concentric pieces of pipe immediately preceding primary meter element; high temperature steam experience of Detroit Edison Co.; 1000 F turbine installation dismantled and examined; steam corrosion tests on various steels; changes in magnitude of piping system; creep determinations; welds examined; tensile strength and elongation; use of models in determining expansion forces in piping systems; arrangement of test apparatus; illustration of fixture.

Charts Simplify Pipe Size Selection for Industrial Water Piping Systems, by E. A. Windham
Vol. 11, *No.* 12. *December*, 1939. *p.* 747
Pressure losses in water piping systems; types of systems; charts for pressure loss for use in sizing piping; chart showing approximate economical pressure drop for water piping systems; examples showing use of data.

Committee on Grounding Hears Report on Research, by Howard S. Warren
Vol. 11, *No.* 9. *September*, 1939. *p.* 557
Report of technical subcommittee to American Research Com-

mittee on Grounding, which is studying corrosion of piping due to electrolytic action; failure of copper tubing in residences; staining of fixtures; effects on electrical grounding of the use of cement-asbestos mains instead of metallic mains; laboratory studies of corrosion of metals; the problem of obtaining and maintaining a satisfactory grounding attachment to water pipe.

Consolidated Edison Installs Steam and Condensate Piping, by M. A. Guigou and S. W. Spielvogel
Vol. 11, *No.* 5. *May,* 1939. *p.* 303
Continuation of discussion of article in April, 1939, HPAC; new steam and condensate piping between Hudson Ave. and Gold St. stations of Consolidated Edison Co. of New York; piping joints and materials; method of welding; piping specifications; stress relieving; support of indoor piping; flat link chain hangers; insulation; pressure reducing and desuperheating system, and diagram of it and its control.

Controlling Quality of Pipe Welds, by R. W. Breckenridge
Vol. 11, *No.* 6. *June,* 1939. *p.* 354
Use of arcronograph in connection with welding of high pressure and temperature piping at Iowa Power and Light Co. plant at Des Moines; the welding process; arcronograph records; interpretation of records; welding a vertical joint; advantages and disadvantages of arcronograph.

Current Types of Gaskets and Closures, by "Parameter"
Vol. 11, *No.* 8. *August,* 1939. *p.* 500
Description of current types of gaskets and closures which are taking the place of usual bolted joint constructions; manhole type joints; ring type joints; smooth forged and machined rings; calorized rings used in refineries; the bellows type joint; force diagram for standard ring type joint; details of bellows gasket, bellows gasket with lens ring, and bellows gasket with solid profile ring.

Current Types of Gaskets and Closures, by "Parameter"
Vol. 11, *No.* 9. *September,* 1939. *p.* 565
Descriptions and diagrams of lock-head construction, design for the drum of a mercury boiler, cover joint for reaction vessels, the wave ring joint, a joint for an ammonia converter and joints using pressure filled gaskets; discussion of details of design.

Establishing Design Pressures for High Pressure Boiler Feed Piping, by H. N. Boetcher
Vol. 11, *No.* 9. *September,* 1939. *p.* 547
Advent of higher steam pressures and temperatures in power plants has forced more careful consideration of design of boiler feed piping; selection of wall thickness is influenced by plant conditions; boiler code and code for pressure piping; factors influencing pressures in boiler feed piping—possible shocks, characteristics of boiler feed pumps, and characteristics of pump drive; various operating conditions; typical characteristic curves for high pressure boiler feed pump; margin in safety offered by differences between hydrostatic test pressures and potential maximum operating pressures should receive more attention.

Estimating Labor Costs for Piping Installations, by George E. Deatherage
Vol. 11, *No.* 6. *June,* 1939. *p.* 365
Various methods of estimating piping labor; the percentage method; use of unit operation costs; use of materials plus estimated labor for each line or branch; welding costs; ticket for recording labor time; forms for recording welded piping costs; advantages and disadvantages of various methods.

Fabrication Details for High Pressure and Temperature Piping, by Arthur McCutchan
Vol. 11, *No.* 3. *March,* 1939. *p.* 141
Description of details for the 865 lb, 910 F steam piping for the extension of the Delray station of Detroit Edison Co.; bypass and drip connections; welded thermocouple and thermometer wells; use of chrome-silicon-moly material; design of backing rings; trend is toward lighter backing rings; partially recessed rings; backing ring dimensions and details of welding bevels; discussion of various welding bevels; diagram of welding bevels adopted as recommended practice by ASA sectional committee; ring reinforced welded branch connection and pipe to valve weld.

Fabrication Details for High Pressure and Temperature Piping at Delray, by Arthur McCutchan
Vol. 11, *No.* 4. *April,* 1939. *p.* 215
Reduced outlet welded branch connections; backing ring with spacing pins; full size welded branch connections; application of backing rings to full size welded branch connections; reinforcing rings for sides of manifolds; illustrations showing methods of beveling, component parts of branch connections, sections through crotch of welded test manifold, stress in unreinforced manifold and shape of backing rings.

Fabrication Details for Welded Piping, by F. P. Woumans
Vol. 11, *No.* 6. *June,* 1939. *p.* 371
Eliminating necessity for upsetting the pipe to increase its section at welded joint; preheating and stress relieving; use and selection of backing rings; details showing typical sections of upset pipe with welds and backing rings; designs for welded joints recommended by author; design for backing ring.

From a Field Engineer's Notebook—Methods of Supporting Piping, by Allen M. Perry
Vol. 11, *No.* 1. *January,* 1939. *p.* 29
Sketches showing various methods of supporting piping based on experience with a large piping modernization project; key to finding type of pipe support for various conditions met with in the field.

From a Field Engineer's Notebook—Methods of Supporting Piping, by Allen M. Perry
Vol. 11, *No.* 2. *February,* 1939. *p.* 102
Sketches showing various methods of supporting piping based on experience with a large piping modernization project; key to finding type of pipe support for various conditions met with in the field.

Heat Transfer and Viscosity Effects in Ammonia Shell and Tube Brine Coolers, by Richard J. Panlener
Vol. 11, *No.* 6. *June,* 1939. *p.* 351
(Part 1); review of data and tests on heat transfer in horizontal shell and tube coolers used for cooling calcium chloride brine; factors affecting heat transfer; evaporating temperature; initial and final brine temperature; logarithmic mean temperature difference; brine concentration and specific heat; brine velocity; number of passes; tube size; condition of surface; arrangement of surface; refrigerant connections; variation of viscosity and specific heat of calcium chloride brine; heat transfer in flooded brine coolers as function of brine temperature.

Heat Transfer and Viscosity Effects in Ammonia Shell and Tube Brine Coolers, by Richard J. Panlener
Vol. 11, *No.* 8. *August,* 1939. *p.* 497
(Part 2); boiling point depression; effect of brine viscosity; effect of swirl strips; formula for overall heat transfer in flooded ammonia horizontal multipass shell and tube brine coolers without swirl strips; conclusions; bibliography.

High Pressure and Temperature Piping Progress During the Past Ten Years, by A. G. Christie
Vol. 11, *No.* 5. *May,* 1939. *p.* 277
Standardization of valves and fittings for high pressures; trend to high steam pressures and temperatures an outstanding development; problems with high temperatures; superheater tubes; creep; studies on lead models of pipe lines; bolting material; action of steel pipe under repeated or alternating loading; data on creep; corrosion at high steam temperatures; results of studies; scale inhibits subsequent attack; welding of piping; research on materials; reheating cycles; application of steam storage in accumulators; creep-stress curves for a steel at various temperatures.

High Pressure Pipe Welding Joints—A Review and a New Development, by H. N. Boetcher
Vol. 11, *No.* 11. *November,* 1939. *p.* 678
Improved equipment and technique for welding, and rigid qualification tests, have made joint design for welded power piping installations of greater relative importance; root design of vital importance to soundness of highly stressed pipe weld; use of separate backing rings; disadvantages of separate backing rings resulted in development of joint involving "integral backing rings;" new joint design developed for high pressure extension to Westport Station, Baltimore, Md.; oxy-acetylene welding used for the small bead for joining the lips, followed by metallic arc welding; sketches of various joint designs; photographs showing new joint and tests of it; results of tests made on new joint.

How a Leaky Pipe Flange Was Repaired on the Run, by A. J. Forbess
Vol. 11, *No.* 11. *November,* 1939. *p.* 690
Welding used to make temporary repair on leaky pipe flange in sugar juice line while in operation; use of welding obviated shutting down the plant.

How to Select and Install Spring Hangers for Piping, by W. F. Fischer
Vol. 11, *No.* 8. *August,* 1939. *p.* 491
Reason for using spring hangers for piping; scale value of spring; number of working coils; free height, set height and solid height; compression; pitch; formulas for spring capacity and deflection; tables for spring calculations showing capacity and deflection for various spring sizes; selecting a spring for a dead load only; selecting a spring to provide for expansion or contraction; selection of springs for riser hangers; methods of adjusting, supporting and guiding springs.

How to Weld Heavy Wall Pipe with the Single Flame, Multi-Layer Technique, by M. R. Scott
Vol. 11, *No.* 10. *October,* 1939. *p.* 623
Advantages of the single flame, multi-layer welding technique; joint design; spacing; welding rod; flame adjustment; tack welds; principles of puddle control; overhead welding; vertical welding; horizontal-vertical welding; the multi-layer technique; heat treating the weld metal; speed and consumption figures for multi-layer welding tabulated.

How Trouble With a Vacuum Pump Was Corrected With Lift Fittings, by W. F. Fischer
Vol. 11, *No.* 9. *September,* 1939. *p.* 562
Vacuum return line heating pump in boiler room raced and clattered; fundamental reasons for the pump giving trouble; quantity of water needed to condense flash vapor; how lift fittings were installed to correct the trouble; use of screwed pipe fittings in making lift fittings; recommendations for installation of fittings; details.

Installation of Compressed Air Equipment Covered in New Code, by Dan L. Royer
Vol. 11, *No.* 5. *May,* 1939. *p.* 288
Discussion of provisions of new Safety Code for Compressed Air Machinery and Equipment which relate to installation; compressors; cooling; piping; valves; receivers; gages and safety valves; reasons for the various requirements.

Manufacture of Brass and Copper Pipe
Vol. 11, *No.* 9. *September,* 1939. *p.* 548
Brief article listing processes by which brass and copper pipe and tube are manufactured; processes illustrated by dioramas at New York World's Fair.

Multi-layer Construction of Thick Wall Pressure Vessels
Vol. 11, *No.* 10. *October,* 1939. *p.* 605
Brief abstract of paper presented by T. McLean Jasper before American Petroleum Institute meeting; reasons for developing multi-layer construction; brief description of this construction.

New Charts for Figuring Friction Loss in Piping, by E. A. Windham
Vol. 11, *No.* 1. *January,* 1939. *p.* 6
The Fanning equation; use of charts simplifies use of equation; charts showing $(\triangle PD/S)$ for various velocities and for various values of (DS/Z), where $\triangle P$ is pressure loss, S is specific gravity, D is pipe diameter and Z is viscosity; examples showing use of charts in figuring pressure drop due to flow of brine and flow of air.

New Safety Code Tells How to Operate and Maintain Compressed Air Systems, by Dan L. Royer
Vol. 11, *No.* 7. *July,* 1939. *p.* 429
Discussions of sections of American Standards Association Safety Code for Compressed Air Machinery and Equipment dealing with operation and maintenance; protective devices; guarding moving parts; lubrication; leaky valves; desirability

of after-coolers; drains and traps; care of hose and tools; importance of adequate working space and aisles; safety valves.

Oxy-Acetylene Welding Developments Described at IAA Annual Convention
Vol. 11, *No.* 5. *May,* 1939. *p.* 296
Abstracts of several papers presented at the annual convention of the International Acetylene Association; Welding High Pressure Piping, by Arthur N. Kugler—tests; the nick break test; methods of welding; welding carbon-molybdenum steel pipe; stress relieving. New Developments in Welding Fittings, by E. Hall Taylor—proposed standard for welding fittings; socket fittings; reinforcing of branch connections; features of welding fittings. Latest Practices in the Pipe Line Field, by W. B. Poor—new and improved tips and rod; field stress relieving of arc welds; development of wrinkle bending; method of making wrinkle bends; advantages. Use of Oxy-Acetylene Welding in the Plumbing, Heating and Air Conditioning Contracting Fields, by Frank E. Wallace—welding of piping for Andrew Jackson housing project, Nashville, Tenn.; use of welding in installation of air conditioning equipment; support of cooling towers.

Pipe Welding Problems Get Attention at Welding Society Annual Convention
Vol. 11, *No.* 12. *December,* 1939. *p.* 732
(Report of annual meeting of American Welding Society); reinforcement of welded nozzles, by F. C. Fantz and W. G. Hooper; simplified method using formulas in ASME code for unfired pressure vessels presented; use of nozzle reinforcing saddles; discussion by Arthur McCutchan; need for reïnforcement; ring and side plate design; oxy-acetylene welding of red brass pipe, by Arthur N. Kugler; liquid flux developed; container for fluxing the rods on the job; welding galvanized pipe; special pipe and pipe fitting applications, by E. Hall Taylor; effect of forge upsetting on electric welded seams; making special pipe fittings with standard welding ells; welding in valve manufacture, by W. F. Crawford and L. H. Carr.

Piping and Handling Heavy Fuel Oils for Boilers and Industrial Furnaces, by Paul R. Unger
Vol. 11, *No.* 10. *October,* 1939. *p.* 606
Medium size fuel users showing greater interest in burning heavier fuels; principal problem is one of transportation; atomization temperature; oil pumping temperature; methods of maintaining temperatures in storage tanks; use of hot water coil; arrangement of oil suction lines; duplicate pumps; electric heaters; oil preheaters and pumping units; piping layout; thermostats; insulation of hot oil lines.

Piping and Handling Heavy Fuel Oils for Boilers and Industrial Furnaces, by Paul R. Unger
Vol. 11, *No.* 11. *November,* 1939. *p.* 664
Problem presented by cold oil in individual takeoff lines; how a typical plant consisting of 15 industrial furnaces was modernized to burn heavy oil; piping layout; control of oil temperature; typical piping diagram for supplying heavy oil to process furnaces; combinations of boilers and process furnaces; installation at Northwestern Malt Co. plant consisting of three 150 hp boilers and 18 burners operating direct fired malt kilns; booster electric oil heater used; piping pitch for firing boilers; temperatures determined for efficient pumping and burning of the pitch; Bunker C oil used as light oil standby.

Piping and Measurement Engineers Must Work Together for Flow Meter Accuracy, by L. K. Spink
Vol. 11, *No.* 11. *November,* 1939. *p.* 683
Importance of appreciating relationship between piping design and layout, and flow metering; pressure losses in piping; effect of enlargements and restrictions; disturbed flow; effect of various types of flow disturbances plotted; use of straightening vanes; meter accuracy depends upon the installation—ratio of orifice to pipe size, approach piping, orifice meter flange, and instrument location; design of the orifice; summary of important points.

Piping Design and Installation at the Irvin Works of Carnegie-Illinois Steel
Vol. 11, *No.* 8. *August,* 1939. *p.* 481
Piping systems for over 20 different services at Irvin Works of Carnegie-Illinois Steel Corp.; erecting welded steam line; coke oven gas line; glass tubing inside copper tubing used for handling hydrochloric acid; identification, painting and stenciling of piping systems; orifices in lines to unit heaters for safety; explosion heads on low pressure side of reducing valves; four alternate systems for supplying water for furnace skid cooling; miscellaneous piping details—valves; flanges, bends, etc.

Piping Services in a Sugar Factory, by A. J. Forbess
Vol. 11, *No.* 7. *July,* 1939. *p.* 439
Brief description of piping features of Amalgamated Sugar Co.'s new beet sugar factory, Nyssa, Ore.; welded steel piping; individual trapping; use of lubricated plug cocks on suction and discharge of juice pumps; piping services and materials; pumps.

Preparing the Piping Estimate, by George E. Deatherage
Vol. 11, *No.* 4. *April,* 1939. *p.* 223
Importance of properly prepared piping plans; recommendations; form for listing of materials and description of use; pricing the material lists; estimating fabrication and erection costs; shop sketches; advantages of a regular routine.

Readers Ask Information on Underground Steam Line. . . Heating a Cordage Mill (Answered by Samuel R. Lewis)
Vol. 11, *No.* 1. *January,* 1939. *p.* 12
An answer to reader's question about how condensate in an underground steam line can best be disposed of; grade of the piping; drain pockets; extra heavy fittings recommended; pitching steam piping; heating a cordage mill where spinning machines induce large quantities of lint; indirect heating system with air washers recommended; preventing spray heads from clogging; design eliminator plates with removable tops.

Real Cost of Refrigeration Piping, The, by R. C. Doremus
Vol. 11, *No.* 2. *February,* 1939. *p.* 98
Cost of refrigeration piping is composed of initial capital cost of installation and cost of operating; factors which affect choice of pipe size; suction piping; comparative data with different suction pressures and typical cost with proper size and small size suction mains; discharge piping; comparative data with different discharge pressures; chart for estimating savings in power cost produced by a drop in condenser pressure; importance of properly sized refrigeration piping.

Rectifiers Protect Piping from Electrolytic Corrosion, by I. R. Smith
Vol. 11, *No.* 3. *March,* 1939. *p.* 153
Electrolytic corrosion of pipe lines, cable sheaths and other underground structures; how currents cause pitting; stray currents; electrolytic currents; protective measures—insulation, drainage, and cathodic protection; characteristics of copper oxide rectifiers; performance curves; how rectifiers are applied to prevent electrolytic corrosion; protection of water tanks.

Safety Valves for Unfired Pressure Vessels
Vol. 11, *No.* 5. *May,* 1939. *p.* 292
Answer to a reader's question on why ASME code for unfired pressure vessels specifies size of safety valve for air receivers shall not exceed 3 in.

Standard for Welding Fittings
Vol. 11, *No.* 2. *February,* 1939. *p.* 93
Draft of proposed American Standard for welding fittings completed by subgroup of committee on standardization of pipe flanges and flanged fittings; copies being distributed for criticism and comment.

Steels for High Pressure and Temperature Service, by J. C. Hodge
Vol. 11, *No.* 7. *July,* 1939. *p.* 417
(Information taken from paper presented at Midwest Power Conference); steels for service at high pressures at temperatures below approximately 650 F, where elastic properties of steel are of primary importance; between 650 and 950 to 1000 F, where high temperature strength is important but where oxidation is not a factor, and at temperatures above 950 to 1000 F where oxidation factor must be considered; considerations involved; effect of various alloying elements; oxidation of metals by high temperature steam; scaling; creep; weldability; thermal expansion; curves giving data on the foregoing.

Suggested Dimensions for Pipe Flanges and Flanged Fittings for 4000 Lb, 900 F, by A. M. Houser
Vol. 11, *No.* 7. *July,* 1939. *p.* 443
Need for pipe flange and flanged fitting standard in a pressure and temperature class higher than 2500 lb; materials and ratings; type of joint; ring joint gaskets; flange thicknesses and stresses; wall thicknesses; sizes and dimensions for 4000 lb, 900 F.

Supporting and Erecting a 24 Inch Steam Tie Line, by M. A. Guigou and S. W. Spielvogel
Vol. 11, *No.* 4. *April,* 1939. *p.* 229
Description of steam and condensate lines between Hudson Ave. and Gold St. stations of the Consolidated Edison Co. of New York; general features of the piping design; support of outdoor piping; load combinations and anchorage; expansion joint; hangers; outdoor piping erected from timber bents; sponge felted insulation.

Trend to Welded Valve Bonnets Seen at New York Power Show
Vol. 11, *No.* 1. *January,* 1939. *p.* 35
Noticeable trend toward welded bonnets; welding end valves threaded or provided with special collars so that valves may be tested without undue stresses such as the compressive force of a yoke to seal the valve ends.

Use of Ring Joints
Vol. 11, *No.* 5. *May,* 1939. *p.* 298
Large oil refinery specifies ring type joints for 2, 2½ and 3 in. sizes of 150 lb steel flanges and for 300 lb flanges for all installations where temperatures are above 600 F and for all oil line flanges from 400 to 2500 lb; 4-6 chrome alloy material used for rings; reason for using ring type joints.

Welding Assures Tight Piping System for Moody Bible Institute's Building, by J. A. Hudson
Vol. 11, *No.* 8. *August,* 1939. *p.* 504
Piping for vacuum heating system in Moody Bible Institute administration building, Chicago, oxy-acetylene welded; number of feet of pipe and number of welds in different pipe diameters; fabricated fittings; anchors and supports; assembling and erecting unit sections.

Welding Carbon-Moly Pipe at Delray, by Sabin Crocker
Vol. 11, *No.* 1. *January,* 1939. *p.* 21
Carbon-molybdenum steel being used for 865 lb, 910 F steam piping in extension of Delray station of the Detroit Edison Co.; review of Detroit Edison welding practice; preventing air hardening; need for preheating; preheating procedure; use of electric resistance preheating equipment; stress relief with induction heaters; photographs and schematic diagram of induction stress reliever; typical temperature conditions observed in stress relieving a weld in 10 in. diameter carbon-moly pipe.

Welding Carbon-Moly Pipe at Delray—Quality Control, by Sabin Crocker
Vol. 11, *No.* 2. *February,* 1939. *p.* 89
Importance of precautions to avoid failure of joints in high pressure piping; qualification of welds; system of qualification tests sponsored by American Welding Society; coördination and adequate supervision essential; duties of the welding operator, the welding supervisor, and the welding engineer; use of the arcronograph as an inspection aid; brief description and illustrations of the instrument; Detroit Edison relies on arcronograph for routine check and confines the use of radiography to laboratory exploration of new designs in verifying their soundness; value of sectioning pilot specimens; sections from branch connection of a welded manifold cut up for observation; principle of operation of arcronograph; typical good and bad arcronograph charts obtained during qualification tests of different welders.

Wide Variety of Piping Serves New Steel Plant, by Floyd Woumans
Vol. 11, *No.* 3. *March,* 1939. *p.* 166
General description of piping for Irvin Works of Carnegie-Illinois Steel Corp., Pittsburgh district; one of the largest industrial piping contracts ever undertaken; 35 electric and 53 gas welding machines used; almost every kind of piping material required; the various piping systems and their functions.

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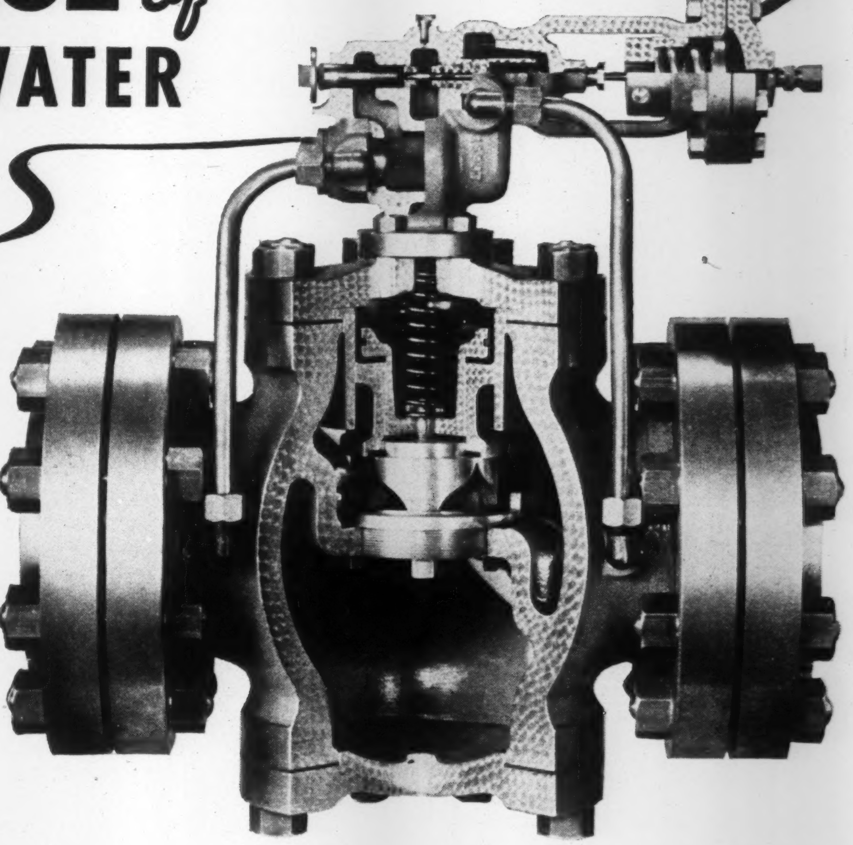

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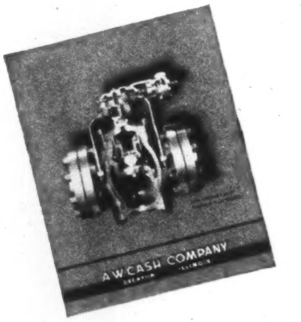

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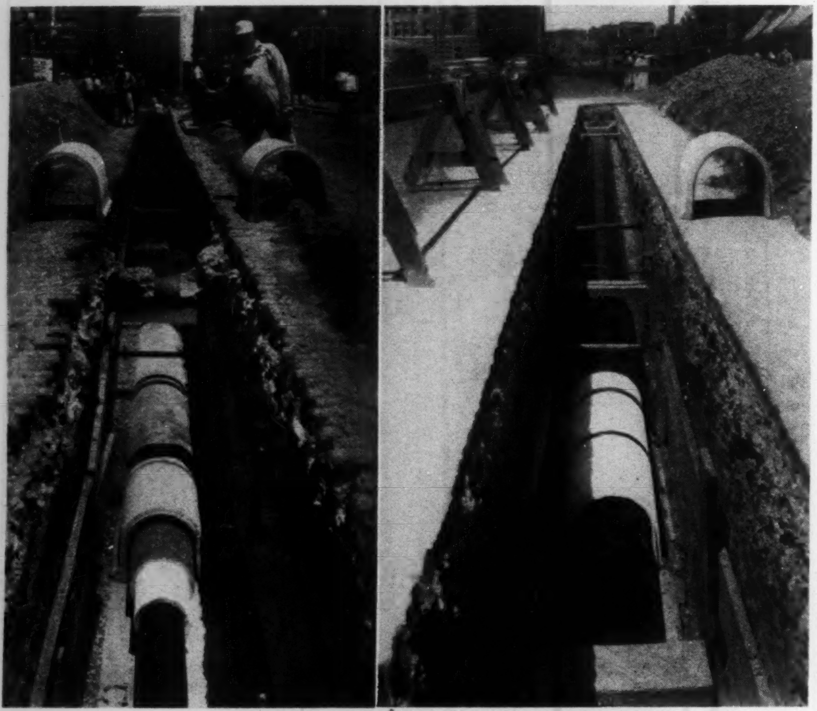

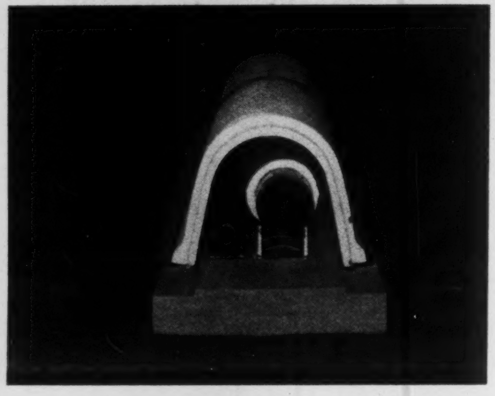

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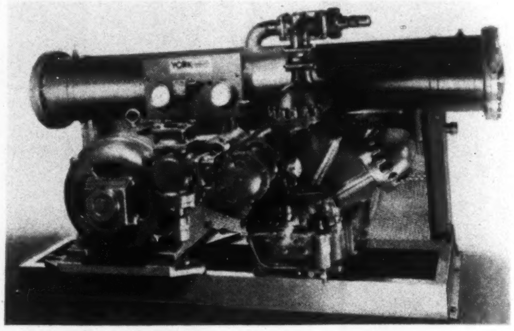

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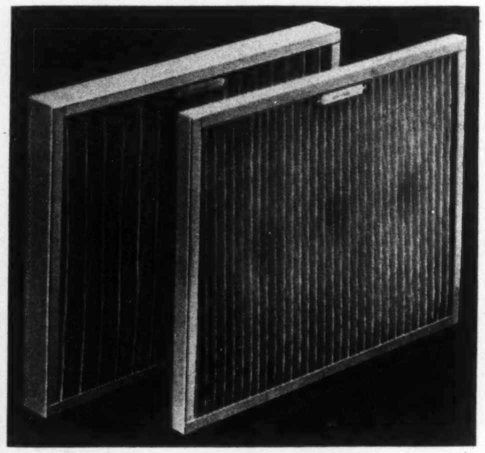

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A NEW and EXCLUSIVE development in controlled heating that offers a broader and more attractive sales opportunity. EACH SYSTEM is individually engineered to meet exact requirements. Designed for either manual or thermostatic control.

Control of steam generation to vary the continuous supply of low temperature steam with ILLINOIS SELECTIVE PRESSURE SYSTEMS opens a new and lucrative field for the sale of control systems in apartments, schools, churches, commercial and public buildings . . . control that heretofore has been adaptable to only the larger heating installations.

In large installations where process steam or zoning requirements do not permit the variable control of combustion, and in housing projects or on Central Station service, ILLINOIS FLOW CONTROL VALVES are used. They are of the full floating type, giving complete regulation of steam flow. Furnished for manual, pneumatic or electric operation.

MODERNIZATION

ILLINOIS SELECTIVE PRESSURE SYSTEMS are the perfect answer to the Modernization problem. Existing vapor or vacuum installations of ANY size may be changed over at low cost to give the convenience and economy of perfect control—a small investment that will return big dividends in fuel saving, heating comfort and owner satisfaction.

Write for bulletins 16 and 517, which describe and illustrate this outstanding development in modern heating

HEAT CONDITIONING FOR
COMFORT

ILLINOIS ENGINEERING COMPANY
2045 SOUTH RACINE AVENUE, CHICAGO

FULTON
Sylphon
TRADE MARK
FOR
TEMPERATURE
CONTROL

• of Individual Radiators

Sylphon Automatic Radiator Valves—simply used to replace ordinary radiator valves in one room, a suite or an entire building—regulate the flow of steam to each radiator according to the individual room's comfort requirements.

Because these self-contained and self-powered reliable controls cost so little, are so easy to install in new or old buildings without alterations, and return so much in tenant satisfaction and fuel economy—they are a paying investment in any modernization project, large or small.

Made in types for both exposed and concealed radiation. This latter exclusive two-bulb balanced heat control, illustrated, utilizes both incoming cool air and outgoing heated air from the enclosure to maintain desired temperature at the breathing line. Installed entirely within the enclosure, out of sight—only the attractive adjustment knob is visible. See new bulletin below.

NEW SYLPHON BULLETINS OFFERED

Individual Room Temperature Control—Bulletins AE 80 and AE 70... Zone Control—Bulletin AE 70... Space Heat Control in Large Industrial Areas—Bulletins AE 50 and AE 70 ... Duct Type Heating and Air Conditioning Controls—Bulletin AE 50 ... Service Hot Water Supply Control—Bulletins AE 20 and AE 40... Drinking Water Temperature Control—Bulletin AE 20.

THE FULTON SYLPHON CO.

KNOXVILLE, TENNESSEE

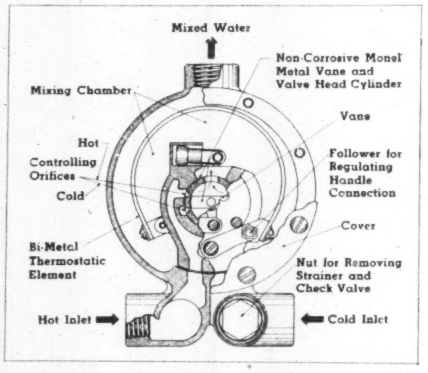
Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England

drain thoroughly.

These panels are furnished in 20 x 20, 20 x 25, 16 x 20, and 16 x 25 in. sizes; special sizes are furnished to order in any width or length up to 500 sq in. for the 1 in. thick filter and 500 sq in. for the 2 in. thick panels.—Air-Maze Corp., 5200 Harvard Ave., Cleveland, O.

Mixing Valve for Industrial Use

No. 1591—For industrial processes where it is essential to maintain constant temperature of water or other liquids of similar viscosity, a new thermostatically controlled mixing valve has been developed.

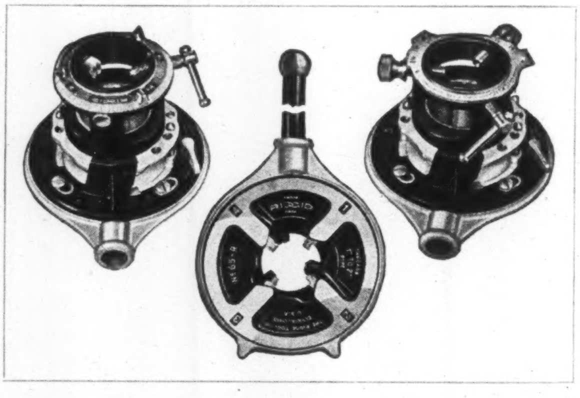

Mixed Water
Non-Corrosive Monel Metal Vane and Valve Head Cylinder
Mixing Chamber
Vane
Hot
Controlling Orifices
Cold
Follower for Regulating Handle Connection
Cover
Bi-Metal Thermostatic Element
Nut for Removing Strainer and Check Valve
Hot Inlet
Cold Inlet

By use of a horseshoe type element, directly linked to the controller vane, instantaneous and positive action is assured without the use of springs, coils, etc., the maker states. Non-corrosive metals are used throughout. Checks and strainers are built in but are accessible from the front without disturbing piping or action. The action, in turn, may be easily removed and manual operation of the valve maintained while it is out of the case.

It is suitable for use in dairies, textile mills, photographic dark rooms, oil refining laboratories, laundry establishments, etc. A temperature variation of not more than plus or minus 3 F with a 50 per cent drop in pressure on one supply line is guaranteed.—Thermo-Mix, Inc., 129 Grand Ave., Brooklyn, N. Y.

New Pipe Threaders

No. 1592—The new "Ridgid" pipe threaders illustrated are now made of all steel and malleable alloy construction with drop forged hardened tool steel cam plates and are said by the maker to give quicker, easier pipe threading. They thread four sizes of pipe (1, 1¼, 1½ and 2 in.) with one set of chaser dies and only four dies stay in the threader, saving time and trouble for the operator.

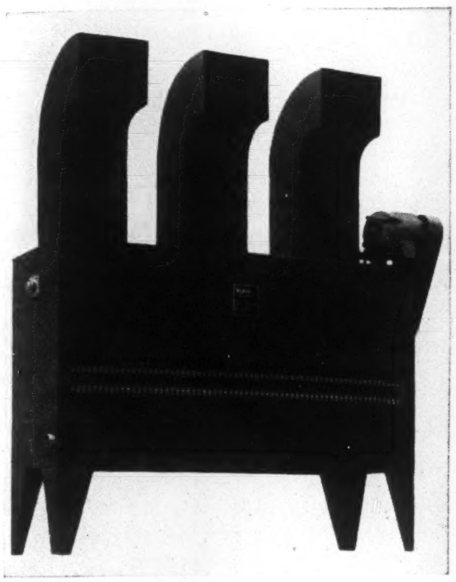


These new threaders offer a choice of two workholders, a cam type and a plate type. There are no bushings—both types simply set to pipe size and are tightened with one screw. The workholders take 2 in. couplings for threading 2 in. close nipples.

The maker has also announced a new series of poster pipe threaders with all steel and malleable alloy construction. Four sets of chasers thread 1 to 2 in. pipe.—Ridge Tool Co., Box 670, Elyria, Ohio.

Unit Heaters in Three Types

No. 1593—A new line of "Webster-Nesbitt Giant" unit heaters is available in three models—standard, "Thermadjust," and valve controlled—and can be furnished in the floor mounted, wall mounted, horizontal ceiling suspended, or inverted types for either v-belt or direct drive. These units are made in nine casing sizes with four sizes of heating elements available for each casing size, making a total of 36 sizes from which to make selections. Capacities range from 3300 to 16,000 cfm and from 125,000 to 1,008,000 Btu per hr with 2 lb steam and 60 deg entering air. All units can be used on steam pressures up to 200 lb gage.



The standard type is also known as the motor controlled type, in which the heating requirements are met by periodic starting and stopping of the fan motor in accordance with the demands of a room thermostat. With the "Thermadjust" or bypass control type, fans operate continuously and the heat output of the unit is regulated by varying the proportions of air passing through the heating element and around it. According to the manufacturer, the advantages of this type may be summed up as closer regulation of room temperature, more even temperature distribution because of constant air circulation, and reduction in stratification with consequent saving in fuel.

Where a continuous supply of all outdoor air or a mixture of indoor and outdoor air is desired for ventilation or for process work, modulation of the steam supply offers the simplest control arrangement, the manufacturer states. As this method cannot be applied to the heating elements employed in the standard or "Thermadjust" units, because of the danger of freezing the condensate when the steam supply is throttled in the presence of sub-freezing air, heating surface with dual steam distributing tubes instead of the regular heating elements is used in the valve controlled units. Under the proper conditions of control and with a steam system adapted to modulating valves, this surface inherently resists condensate freezing.—John J. Nesbitt, Inc., State Rd. & Rhawn St., Philadelphia, Pa., and Warren Webster & Co., 17th and Federal Sts., Camden, N. J.

Evaporative Cooling Units

No. 1594—A line of evaporative cooling units has been developed for use in shops, offices and other places of business. These units can be installed in the wall out of sight, above a vestibule, suspended from the ceiling, or put on a raised platform. They circulate 100 per cent outside air, and are operated by the force of city water pressure so that no pumps or tanks are necessary. The manufacturer has also developed a window type evaporative cooler for use in residences, shops, hotel rooms, single room specialty shops, or beauty parlors which operates on the same principle as the commercial unit does, but on a slightly smaller scale.

On days when the humidity is high the maker recommends that the water supply to the washer be shut off by a humidistat and solenoid valve.

The commercial units are available in models for 110 and 220

Fairbanks
Valves
in this hospital 17 years

A great responsibility rests on the men who select and install valves in a building like the Fifth Ave. Hospital, New York. For valve failure might curtail the water supply and the fire prevention system and jeopardize the lives of hundreds of patients.

You take no chances with Fairbanks Valves. There is over half a century of manufacturing experience and a financially responsible concern back of them.

The Fairbanks Valves installed in the Fifth Ave. Hospital in 1921 are still rendering faithful and efficient service.

Write for Catalog No. 21.

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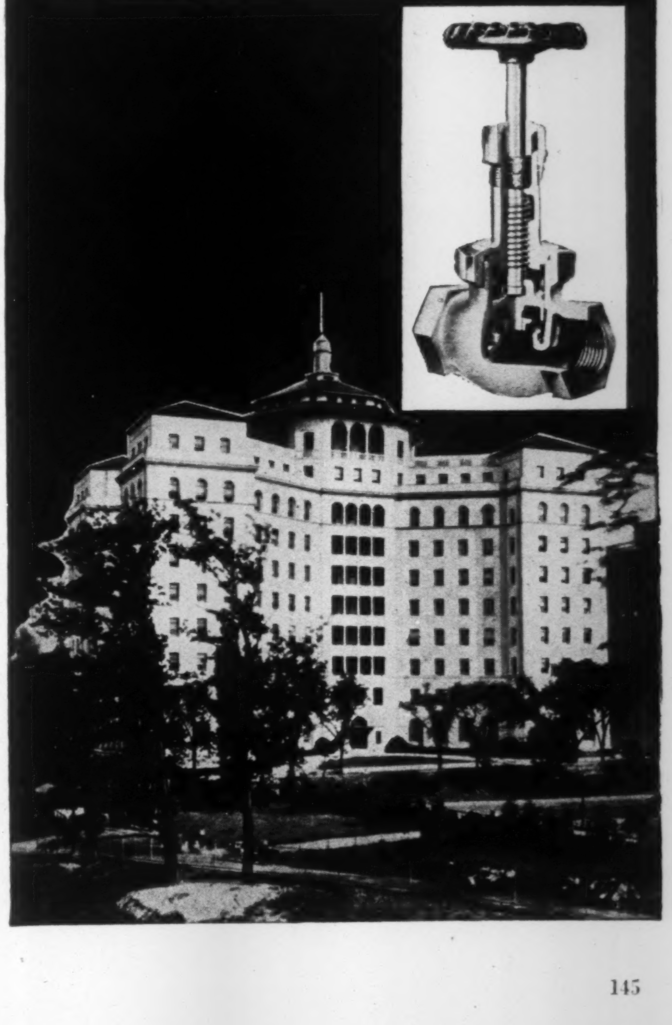
Valves, Dart Unions, Hand Trucks and Wheelbarrows
396 Lafayette St., New York, N. Y.
Boston, Pittsburgh—Distributors in Principal Cities
Factories: Binghamton, N. Y.; Rome, Ga.



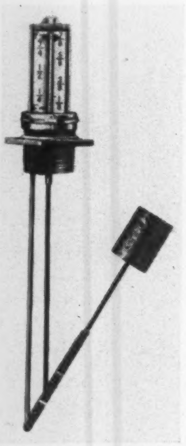
volts and for 3600 and 7200 cfm. The window units are available for 110 volts and handle 850 cfm of air.—Economy Electric Mfg. Co., 4606 W. 21st Pl., Chicago, Ill.

Gage for Fuel Oil Tanks

No. 1595—The new "Clearview" oil gage for inside fuel oil tanks combines a number of features. The large 3 in. scale is easily read and may be quickly adjusted to face in any desired direction. The unbreakable "Tenite" head is oil and pressure tight.

The gage may be installed easily regardless of fuel level in the tank because of its patented flange and union construction. By removing the nickel plated slip nut, the plate may be removed or inserted at any time. It is simple to calibrate without disturbing the lower half of the gage union, as the indicator may be adjusted up or down without removing the gage from the tank.

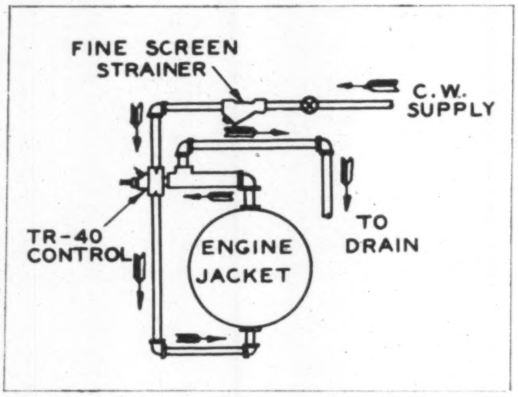
These gages are available in a number of standard sizes.—Detroit Lubricator Co., 5900 Trumbull Ave., Detroit, Mich.



Cooling Water Control

No. 1596—The cooling water control illustrated is an addition to the maker's line of temperature regulators. It has been designed expressly for use on the cooling water jackets of internal combustion engines and compressors and can be employed in connection with water cooling of solvent recovery stills in dry cleaning plants and in degreasers as used in metal manufacturing establishments.

The control consists of a piston valve operated by a liquid expansion thermostat to throttle the flow of cooling water as required to maintain a constant temperature.



The valve is provided with a bleeder port adjustable from the outside. This serves to allow a small amount of cooling water to flow at all times even when the valve is closed. This also keeps the thermostat active and ready to respond.

An important innovation is a safety device in the form of a fusible plug inserted between the thermostat plunger and the valve spindle in such a way that in the event of thermostat failure, the plug will collapse and the water valve will be forced wide open. This makes impossible damage to the engine in the event of thermostat failure, states the maker.

Sizes ⅜ in. to 1 in. are now available and larger sizes are contemplated.—Sarco Co., Inc., 183 Madison Ave., New York, N. Y.

Two New Spray Nozzles

No. 1597—The "Parasol" non-clogging spray nozzle illustrated gives a spray of the hollow cone type with uniform distribution and a wide spray angle. Capacities range from 0.5 to 4.0 gpm at 10 lb pressure, and these nozzles are intended to be used for

11
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"ALNOR" VELOMETER
For Speedy, Accurate AIR VELOCITY READINGS

The "Alnor" velometer in an air velocity meter that indicates velocities directly on the scale in feet per minute without the necessity of mathematical calculations, conversion tables or stop watches. The pointer indications are a direct measurement of the air speed.

With the velometer and jets accurate velocity readings may be taken in locations and positions that would be impossible or inaccessible with other means. Hundreds of users on countless varied installations have found the "Alnor" velometer indispensable as a simple, accurate and convenient means of measuring air velocities.

A postcard request will bring you full information. Write today.

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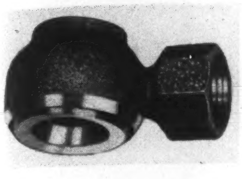
419 N. La Salle Street, Chicago, Ill.



air conditioning, air washers, air coolers, brine spraying, chemical processes or wherever an exceptionally large spray angle is required.

The same manufacturer has also placed a new atomizing spray nozzle on the market for use in humidifying and in various industrial and chemical processes. Capacities range from 1 to 14 gph at 40 lb pressure. Standard stock construction is brass with stainless steel inserts, but other metals can be specified.—Spraying Systems Co., 4922 W. Grand Ave., Chicago, Ill.

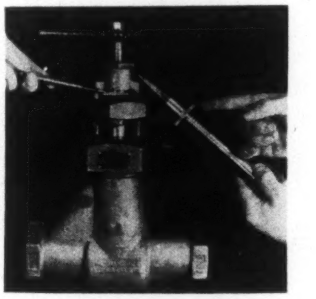
Pillow Block

No. 1598—The new "Rubber-Flex" pillow block comprises a self-locking bearing of the "grip-lock" type which is inherently aligning, thus compensating for inaccuracies of set-up and conditions of shaft misalignment without binding or impairing the load carrying capacity. The bearing is encased in a pressed steel housing equipped with felt seals to exclude dirt, and the housing is provided with means for lubricating the bearing. The bearing and housing are surrounded with an elastic material having special sound absorbing characteristics, and the material is treated to make it impervious to oil and grease.

According to the manufacturer, this pillow block constitutes a rugged, inexpensive unit which has wide application in those fields requiring anti-friction bearings with unusually quiet characteristics. They are first being released in the ¾ in. and 1 in. shaft sizes.—SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

Improved Steel Valves

No. 1599—Improvement of forged and cast steel valves incorporates both the construction and materials used in a renewable stem thread bushing. This part is now made of "Duronze" (an aluminum, copper, silicon alloy). The makers claim that these new bushings completely meet the demand for valves that will operate satisfactorily without lubrication of the stems at elevated pressures and temperatures.



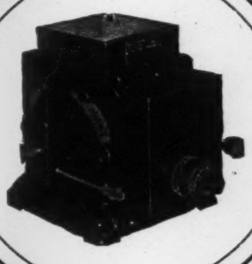
The selection of this particular alloy for this purpose came after extensive tests run in a large utility plant. Bushings of various materials and designs were tested on turbines operating on 670 lb, 820 F steam. Breakdown tests were performed by attaching reversible air drills to the valve handwheels. The makers report that these alloy valve bushings selected still showed no signs of wear after five times the number of operations required to destroy bushings of other materials.—Manning, Maxwell & Moore, Inc., Hancock Valve Div., 11 Elias St., Bridgeport, Conn.

Air Line Strainer and Lubricator

No. 1600—A combination of two new devices is designed to "condition" air for the efficient operation of air tools. These are an air strainer and a sight feed automatic air line lubricator.

The strainer consists of a double screen, a bronze head, and a drawn steel, tin-dipped bowl. A 200 mesh monel metal screen is supported by a 100 mesh brass screen. It is offered in ¼ and ⅜ in. sizes.

Holtzer Cabot
MOTORS
are built Quiet
and
stay Quiet



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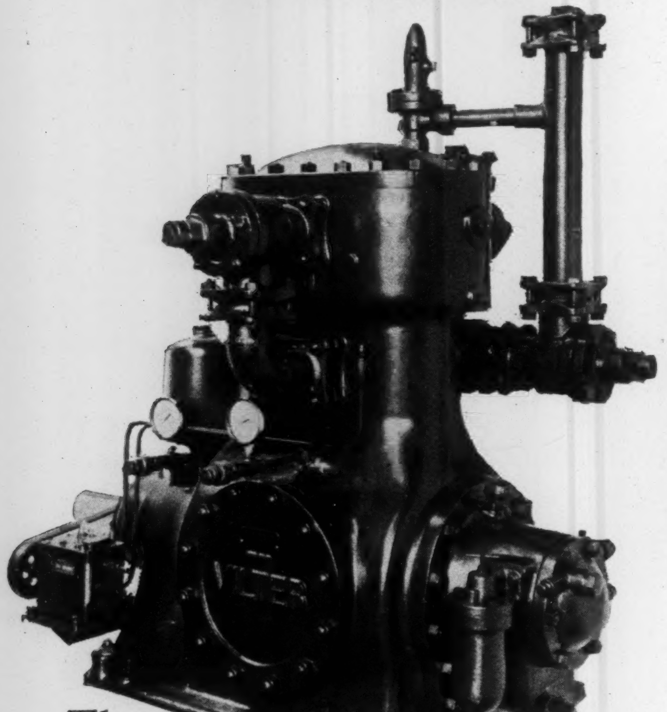
QUIET·SERVICE
·· FREE·FROM·TROUBLE
Let us help solve
your Motor Problem
THE HOLTZER-CABOT
ELECTRIC COMPANY
Boston, Mass.
CHICAGO NEW YORK PHILADELPHIA

When Users of Vilter Air Conditioning say

"Our Vilter Installation has produced *more Tons Refrigeration per H. P.* than any other equipment we've used." . . .

. . . the reason for this unusual efficiency is certainly worth knowing—for it means money in your pocket on your next installation! And the kind of satisfied customers that mean increased business.

Here's the main reason for CUSTOMER SATISFACTION. . .



The VILTER "Freon 12" *Compressor* . .

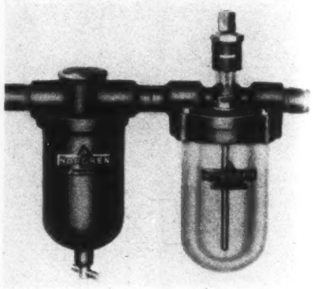
The secret of *Lower Horsepower per Ton* on Vilter Installations is the result of engineering triumphs in REDUCING FRICTION in the Vilter "Freon 12" Compressor. Here are a few of the features that bring about such unusual advantages:

- ***Revolutionary Triple Shaft Seal*—replaces the old time stuffing box — minimizes friction — eliminates Freon leaks at crankshaft.**
- ***Three Main Bearings*—increased free-running bearing surface reduces bearing pressures.**
- ***Crankshaft and Piston*—properly designed and proportioned to minimize side thrust.**
- ***Discharge and Suction Valves*—low lift, large area, reduces gas velocity.**
- ***Streamlined Inlet and Outlet Gas Ports*—reduce gas friction.**

Superior Since 1867 VILTER Air Conditioning Refrigeration . . .

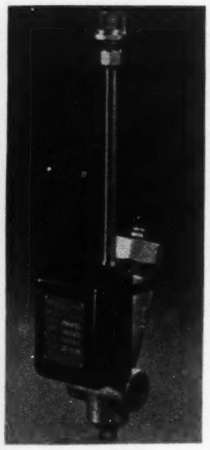
The VILTER MFG. COMPANY
2148 S. First Street
Milwaukee, Wisconsin

Let Vilter show you the way to more profitable Air Conditioning and Refrigeration. Write for Bulletins.



The new lubricator follows in general the patented design of the maker's regular lubricators, with the added feature of a transparent oil reservoir of resilient plastic which, it is claimed, will not chip, stain nor shatter, withstands the Underwriters' 500 lb burst test and is suitable for installations in temperatures up to 180 deg. The transparent bowl allows the oiler at all times to check the reserve supply of lubricant. It is available in ¼, ⅜ and ½ in. sizes, for horizontal lines.—C. A. Norgren Co., Inc., 222 Santa Fe Dr., Denver, Colo.

Low Water Cutout

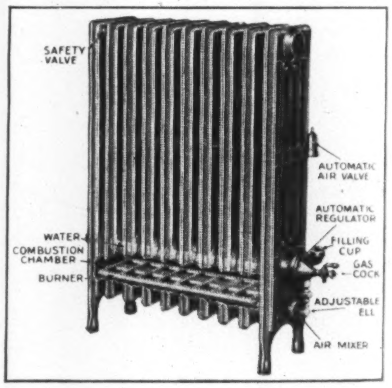


No. 1601—A new all-electric low water cutout provides a positive means for automatically turning off fuel burners when boiler water becomes dangerously low. The operating mechanism is simple. A mercury relay of the rotating armature type (no iron to iron contact) is actuated by current conducted by water in the electrode chamber. A level differential exists between the cut-in point and the cut-out point by virtue of relay characteristics which requires more current to pull in than to drop out. Electrode current is nominal, being but a few hundredths of an ampere, and further permits use of 24 volts on electrode instead of high voltage.

The low water cutout requires a source of 24 volts alternating current for operation.—General Controls, 700 W. Ivy St., Glendale, Calif.

Gas Steam Radiators

No. 1602—A new cast iron gas steam radiator is available in both vented and unvented types. A venturi bunsen type burner is installed in the radiator, entirely enclosed in a cast iron combustion chamber and directly under the water chamber. Natural or manufactured gas is used. The gas supply to the burner is controlled automatically by steam pressure within the radiator.—Automatic Gas Radiator Co., 446 Brushton Ave., Pittsburgh, Pa.

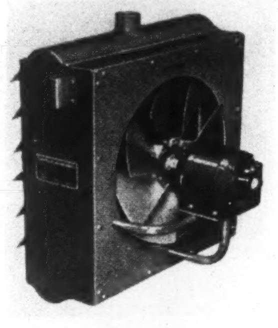


Power Type Pressure Gage

No. 1603—A power type pressure gage suitable for the measurement of extremely high pressures and accurate to one-tenth of 1 per cent of the reading has been developed. It provides accurate pressure readings on an indicating scale and may also transmit these readings to indicators and recorders situated at distant points.

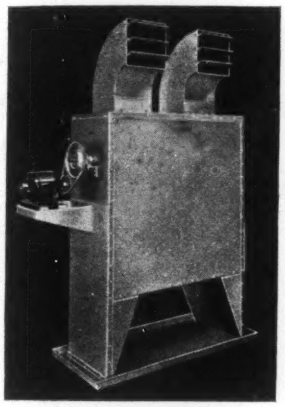
The pressure to be measured is applied to a small pressure piston which supports a pilot valve and a table loaded with removable weights. This portion of the pressure device, which is continuously rotated to eliminate static friction, is similar in principle to a dead weight pressure gage as the applied

SKINNER UNIT HEATERS

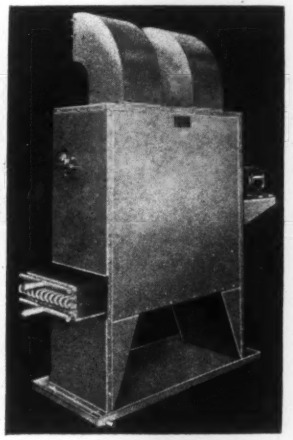


Suspension Type Unit Heater

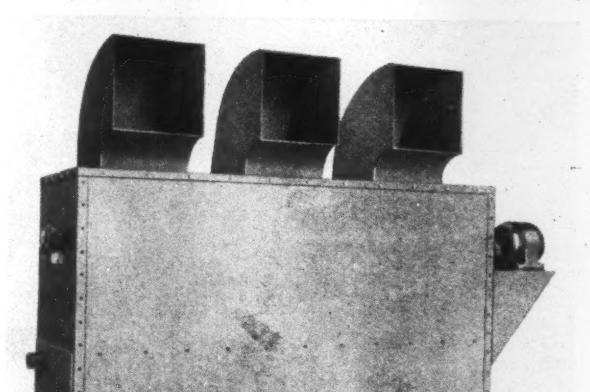
SKINNER UNIT HEATERS, Air Conditioning, Heating and Ventilating equipment are manufactured in our new modern factory which is conveniently equipped and located to give you prompt and efficient service. Sales and service representatives in principal cities. Write TODAY for further information on our complete line. SKINNER HEATERS will make money for you in 1939.



Floor Type Cooling Unit



Fan and Cooling Coil Assembly



Floor Type Unit Heater

Manufactured by

ST. LOUIS BLOW PIPE and HEATER CO., INC.

Sold by

SKINNER HEATING and VENTILATING CO., INC.

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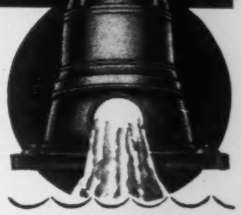
THE MEMPHIS. TENN
MANUFACTURING PLANT OF
LAYNE & BOWLER, INC.

By Right of Conquest



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Layne-Arkansas Co	Stuttgart, Ark
Layne-Atlantic Co.	Norfolk, Va
Layne-Central Co.	Memphis, Tenn
Layne-Northern Co.	Mishawaka, Ind
Layne-Louisiana Co	Lake Charles, La
Layne-New York Co.	New York City and Pittsburgh, Pa
Layne-Northwest Co.	Milwaukee, Wis
Layne-Ohio Co.	Columbus, Ohio
Layne-Texas Co.	Houston and Dallas, Texas.
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Layne-Bowler New England Company,	Boston, Massachusetts.
International Water Supply, Ltd.,	London, Ontario, Canada

THROUGHOUT the entire world, and frequently under the most adverse climatic and water-producing conditions, Layne Wells and Vertical Centrifugal Pumps have more than made good and fully won their uncontested right to claim outstanding superiority in design, construction, quality, and satisfactory performance.

In well sizes from four to sixty inches, and in depths up to 3,000 feet, the record of highest gallonage of water per dollar of annual cost is unmatched by competitive equipment.

So by right of conquest, by proven efficiency during more than half a century of actual use, Layne is fully privileged to claim superiority. Such a record justifies your most serious consideration of Layne Wells and Vertical Centrifugal Pumps on any project where a dependable supply of water must be obtained at a minimum annual operation and upkeep cost.

Let us send literature which fully explains the exceptionally interesting features of Layne Wells and Pumps. Address LAYNE & BOWLER, INC., Dept. K, Memphis, Tenn.

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For Municipalities, Industries, Railroads, Mines and Irrigation

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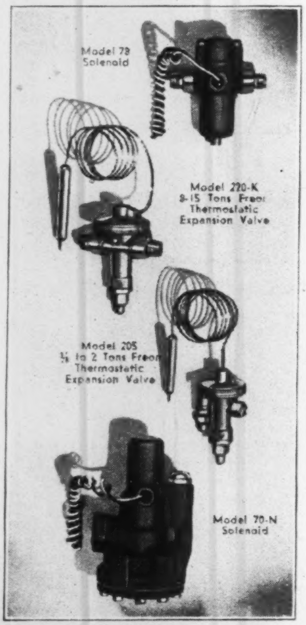
OUR SPECIAL LUNCHEON 45¢
DINNER 75¢

At the *Famous* Sign of the

Galley *"Bernstein S. F."*

Delicious Sea Food will tempt you, too, at Bernstein's famous Fish Grotto in San Francisco. Here the delicate freshness and flavor of sea foods is effectively preserved by specially designed Refrigeration—accurately controlled with A-P Valves.

A-P Valves provide unusual efficiency, sensitivity in Refrigerant Control on famous installations everywhere—on all sizes of Air Conditioning and Refrigeration Units, from ¼ ton and up. Let A-P Valves cut the service costs on your next installation.



Model 78 Solenoid
Model 220-K 8-15 Tons Freon Thermostatic Expansion Valve
Model 205 ¼ to 2 Tons Freon Thermostatic Expansion Valve
Model 70-N Solenoid

Installation
Bernstein's Fish Grotto
123 Powell, San Francisco

Refrigeration Unit
Westinghouse

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Colvin Templeton, Inc.
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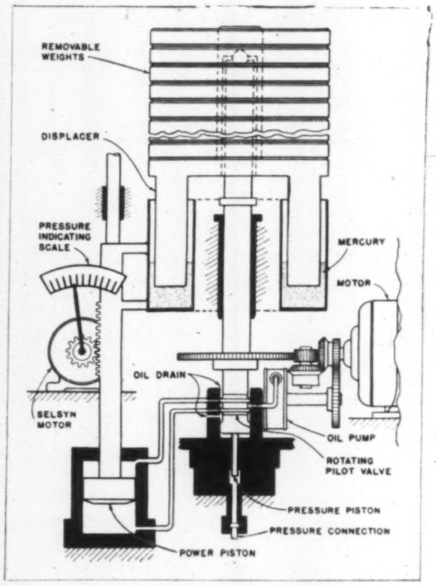
DEPENDABLE
THE BYWORD FOR A-P CONTROLS



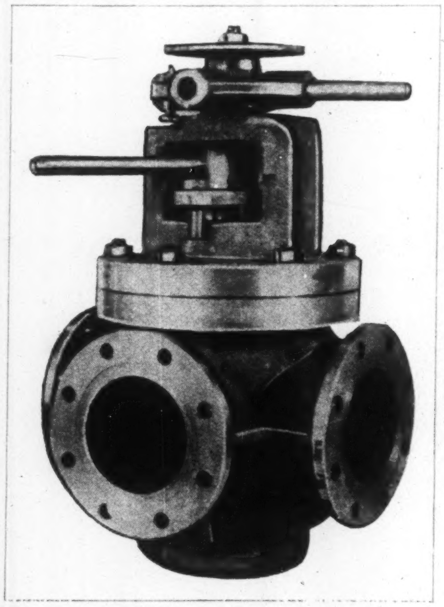
REMOVABLE WEIGHTS
DISPLACER
PRESSURE INDICATING SCALE
MERCURY
MOTOR
OIL DRAIN
SELSYN MOTOR
OIL PUMP
ROTATING PILOT VALVE
PRESSURE PISTON
PRESSURE CONNECTION
POWER PISTON

pressure is counterbalanced by the weight of the table and removable weights less the buoyancy of the mercury on the skirt of the weight table. A small motor serves to rotate the pressure piston and pilot valve, a ball bearing being provided so that the removable weights and weight platform need not rotate. The motor also drives a small oil pump which provides hydraulic pressure for operation of the power piston which in turn moves the mercury cup, the indicating pointer and the "Selsyn" motor for electrical transmission of readings. For each pressure applied to the small rotating pressure piston, a definite position of the power piston, mercury cup and indicating pointer is obtained.

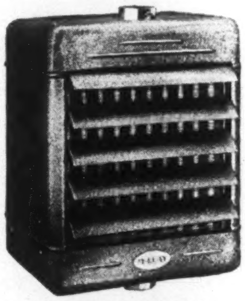
Gages operating on this principle have been built for suppressed ranges and extremely high pressures. One unit was designed for a maximum range of 10,000 to 12,000 lb per sq in., the calibrated range remaining constant at 2000 lb but the amount of suppression being decreased in 1000 lb steps by the removal of weights, one at a time.—Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, Ohio.

Lift Plug Valves

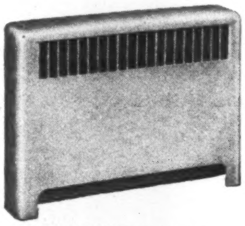
No. 1604—A new line of three way, brass "Easy Turn" lift plug valves has been developed for use on air, water, oil, and gas services at working pressures up to 150 lb and temperatures below 400 F. The valves are available in sizes from 1¼ to 3½ in. and with three different styles of port arrangement — Style D, which permits flow from either end and out the side opening, or *vice versa;* Style E, which permits flow from the left hand end and out the side opening or straight through; and Style F, which permits flow from the right hand end and out the side opening, or straight through.



Direction of flow is changed by a quarter-turn of the operating lever. The powerful leverage and screw of the lift plug feature not only assures easy operation, but permits the plug to be sealed in the body in either of its two extreme positions of travel or in a mid-position so that all ports are closed, according to the maker.—Homestead Valve Mfg. Co., Inc., P. O. Box H, Coraopolis, Pa.



McQUAY UNIT HEATERS
With full floating, all copper heating elements available in 26 sizes. Tubes orificed insuring equal distribution of heating media throughout element. Improved permanent bond between fin and tubes.



McQUAY CONCEALED AND CABINET COPPER RADIATION
Available in all enclosure types, exposed floor and wall hung, fully or partially recessed with removable panels and totally concealed. Incorporating the all copper heating element that has proven itself over years of usage.

McQUAY INC.

1600 Broadway, N. E. Minneapolis, Minn.

MANUFACTURERS OF EQUIPMENT
for all phases of

AIR CONDITIONING

McQUAY AIR CONDITONING COILS

For central fan heating and cooling systems. Coils for dehumidifying; using direct expansion refrigerants as well as water for cooling, steam and hot water for heating. Wide variety of sizes and applications.

McQUAY EVAPORATOR COILS

Designed for all phases of commercial refrigeration work. A flexible line of special tailor-made coils to fit specific requirements.

McQUAY FLOOR TYPE COOLING AND HEATING UNITS

Made in various sizes with cooling capacities up to 50 tons.

McQUAY UNIT COOLERS

Available for walk-in coolers, storage rooms and all types of fixtures where forced-air circulation is desirable. For use with all types of refrigerants including ammonia.

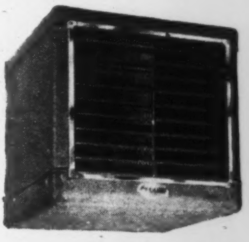
McQUAY SUSPENDED BLOWER TYPE COOLING UNITS

A companion line to the floor type cooling units. Available for combination cooling and heating purposes.

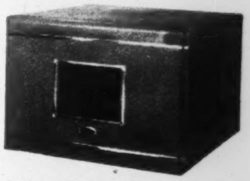
McQUAY CABINET ROOM COOLERS

Floor type, for home or office use. Very dependable and economical. Compact and attractive. Designed to use cold water or refrigerants.

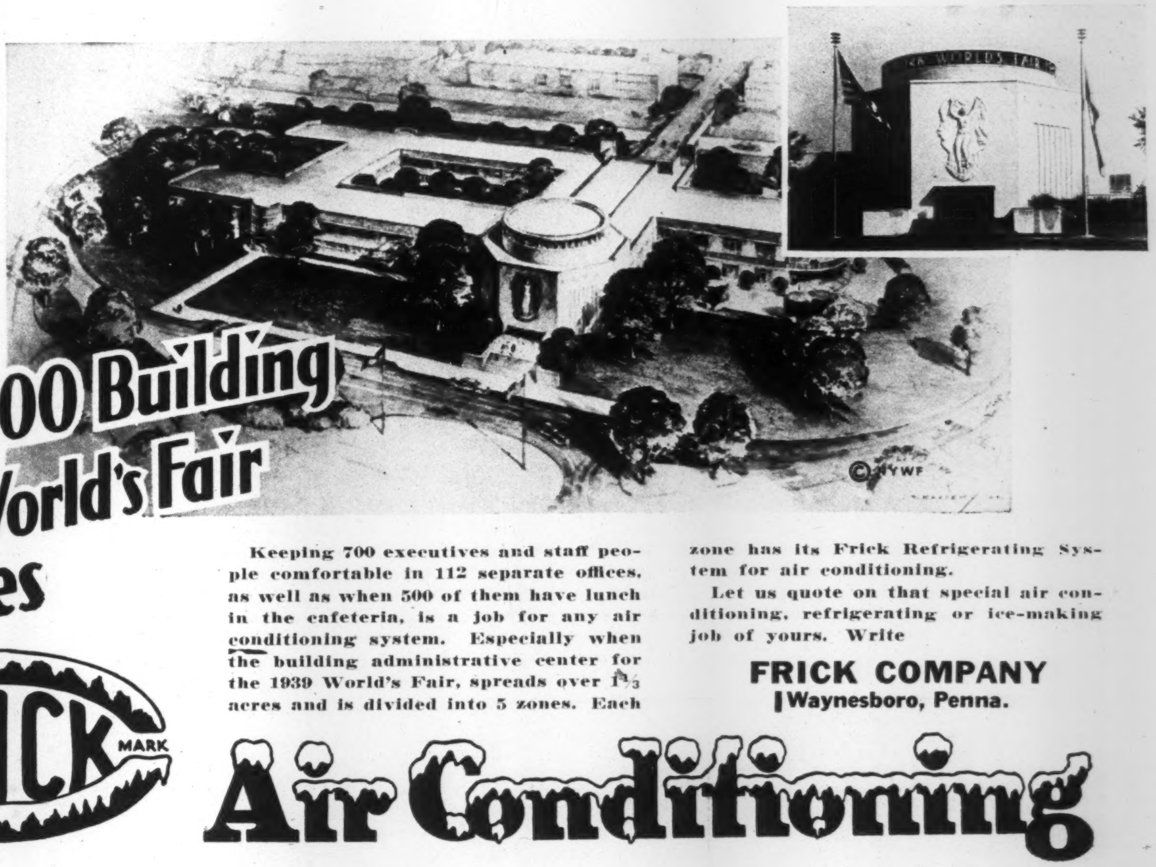
Write for Descriptive Bulletin, now ready.



McQUAY COMFORT COOLERS
For direct expansion refrigerants; also available as combination cooling and heating units; where cold water or brine is used as cooling medium, or steam or hot water as heating medium. Numerous sizes with capacities to fit any requirement.



SUSPENDED AIR CONDITIONING UNITS
A new line of low priced units, incorporating the high efficiency of multi-blade centrifugal fans and air filters. Cold water or Freon as the cooling medium. Housed in attractive cabinets adaptable for fresh air connection.



$900,000 Building at N.Y. World's Fair uses

Keeping 700 executives and staff people comfortable in 112 separate offices, as well as when 500 of them have lunch in the cafeteria, is a job for any air conditioning system. Especially when the building administrative center for the 1939 World's Fair, spreads over 1⅓ acres and is divided into 5 zones. Each zone has its Frick Refrigerating System for air conditioning.

Let us quote on that special air conditioning, refrigerating or ice-making job of yours. Write

FRICK COMPANY
Waynesboro, Penna.

TRADE FRICK MARK

Air Conditioning

For all-round safety and dependability specify...

W-S
FORGED STEEL
FITTINGS

W-S SCREW END FITTINGS

For complete satisfactory service, on pipe lines carrying oil, gas, steam, ammonia or water under high pressures or temperatures, use W-S Forged Steel Fittings.

They are available in a complete range of sizes in screw end style or with socket end for welding.

Both screw end and welding fittings are bored from solid drop forgings. They have heavy walls uniform in thickness which means extra strength and safety in service. Threads are accurately cut and perfectly aligned.

W-S Welding Fittings are provided with a counterbore which assures positive alignment before and after welding.

Use W-S Fittings on your next piping installation, let them prove their worth under actual operating conditions.

Ask for Bulletin A-3.

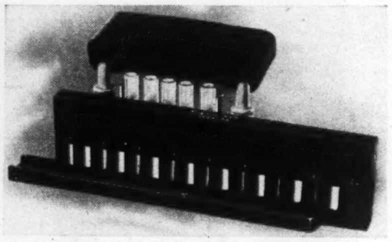
THE WATSON-STILLMAN COMPANY
140 Aldene Road
Roselle, New Jersey

W-S SOCKET END WELDING FITTINGS

FOR HIGH PRESSURE AND
HIGH TEMPERATURE, OIL,
GAS, STEAM, HYDRAULIC
AND AMMONIA SERVICE

pH Slide Comparator

No. 1605—A new slide comparator for the colorimetric determination of pH, chlorine and phosphates is molded entirely from plastic. All pH, chlorine and phosphate values, as well as the indicator names, are engraved in white directly on the plastic slides. Improved catches are used to hold the top on the base and all metal parts are rustproof. The whole outfit, including the slide is 10 in. long, 2⅛ in. wide and 4 in. high and weighs 1½ lb.



The comparator consists of a slide and a base. Each slide contains nine color standards alternating with ampoules of distilled water. The base contains two vials of indicator solution, with 0.5 cc pipettes, five 5 cc test tubes, and a piece of etched glass in a special compartment. Determinations are made by filling three of the test tubes with the test sample, adding 0.5 cc of indicator solution to the middle one, placing the slide on the base and moving it back and forth until the test sample matches one of the color standards. The pH, chlorine or phosphate value is then read off directly from the values on the slide. One base can be used with any number of color standard slides.—W. A. Taylor & Co., 872 Linden Ave., Baltimore, Md.

Small Condensation Pump

No. 1606—A new, small, condensation pump and receiver for heating systems of all kinds where there is a small amount of direct radiation can be used for 500 to 2000 sq ft direct radiation and 10 to 45 lb pressure.

IN
CHICAGO PUMP CO.

The cast iron receiver is small and the float has only a short distance to travel which means that the condensate is returned to the boiler before it has had a chance to cool off, according to the maker. The receiver sits right on the floor or in a shallow pit with no foundation bolts necessary.

The pump is suspended in the receiver from the motor. The motor and pump assembly can be lifted out by loosening a few nuts at the top of the receiver. The pump has a bronze casing and rotor and stainless steel shaft.—Chicago Pump Co., 2336 Wolfram St., Chicago, Ill.

New Strip Heaters

No. 1607—Two new types of strip heaters designed to produce fast, economical heat have just been announced. Made in two temperature ratings of 750 F and 1200 F on the sheath, these heaters are particularly applicable on crane cabs, valve house, elevators, ovens, metal water tanks, pipe lines, hydrants, hot tables, metal moulds, foundry platens—wherever ease of application and convenience are requirements—says the maker.

Heaters may be obtained either with both terminals at one end or at opposite ends for installation convenience. Heating

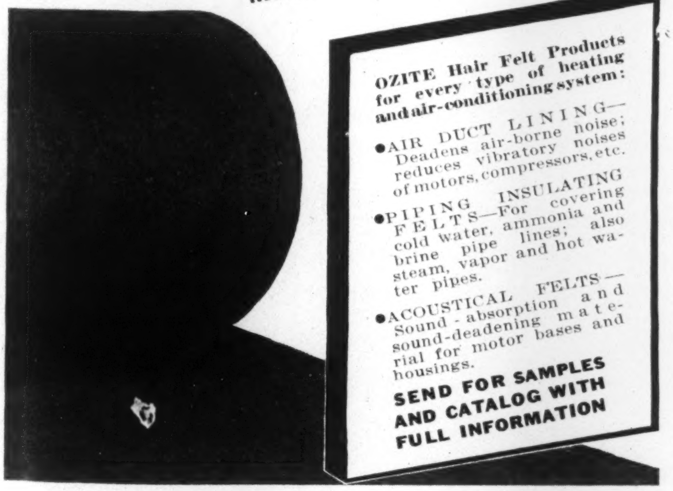
STEP-UP AIR DUCT EFFICIENCY with OZITE HAIR-FELT DUCT INSULATION

THERMAL CONDUCTIVITY ONLY 0.246 BTU'S

You'll lose fewer BTU's, from furnace to register, if your air ducts are wrapped with OZITE Air Duct Insulation . . . it gives lasting protection against heat loss in winter and heat penetration in summer . . . makes every kind of air-duct system more efficient, less expensive to operate.

OZITE Air Duct Insulation is flexible, easy to shape, amazingly simple to install. Made of genuine hair felt—repels vermin, resists fire and moisture, won't rot or decay. Comes in rolls in 3 thicknesses.

AMERICAN HAIR & FELT COMPANY
Merchandise Mart, Chicago



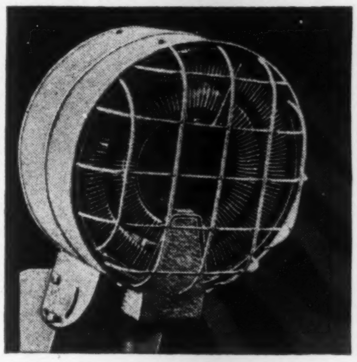
OZITE Hair Felt Products for every type of heating and air-conditioning system:

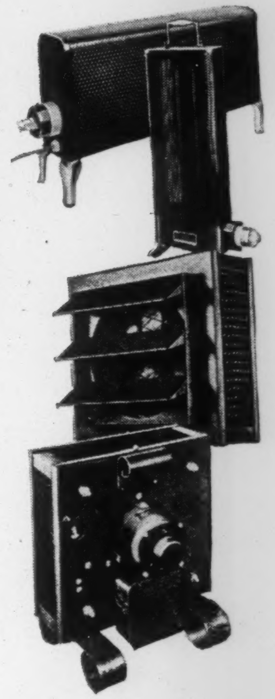
- AIR DUCT LINING—Deadens air-borne noise; reduces vibratory noises of motors, compressors, etc.
- PIPING INSULATING FELTS—For covering cold water, ammonia and brine pipe lines; also steam, vapor and hot water pipes.
- ACOUSTICAL FELTS—Sound-absorption and sound-deadening material for motor bases and housings.

SEND FOR SAMPLES AND CATALOG WITH FULL INFORMATION

Wired heat goes anywhere!

CHROMALOX
ELECTRIC AIR HEATERS





Easy installation under practically any circumstances. Instant operation at any time, day or night, work-day or holiday. Built in types for factory floor, office, salesroom, home—capacities from 1½ to 20 kw. Thermostatic control if desired. These heaters use the famous Chromalox electric heating units, known throughout industry for their endurance and outstanding economy.

CHROMALOX UNITS for industrial ELECTRIC HEAT

The modern way to bring heat to process, machine part, liquid container. Simple application, elimination of fire hazard, reduction of insurance premiums, closer temperature control, better, more uniform product. Many standard forms, ready for quick shipment. A corps of electric heat experts to aid you in selecting and applying the correct unit for any purpose.

Strip Heaters
Ring Units
Immersion Units
Stationary-Portable
Many Other Types

GET THIS CHROMALOX BOOK

With 64 pages of valuable information on electric heat for all heating purposes, and the equipment to provide it.

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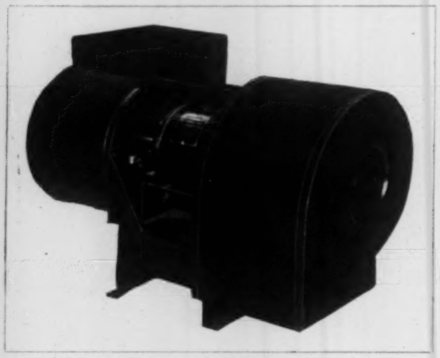
EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa.

Send me the CHROMALOX BOOK OF ELECTRIC HEAT.

Name .... Position ....

elements, with refractory insulation and sealed against moisture, are completely enclosed and bolt holes are provided at each end for quick and permanent installation. They are available for operation on 115 volts, 230 volts and two styles for 250 volts, and include sizes of 8, 12, 18, 24 30½, 36 and 43 in. in length with ratings from 150 to 1250 watts.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

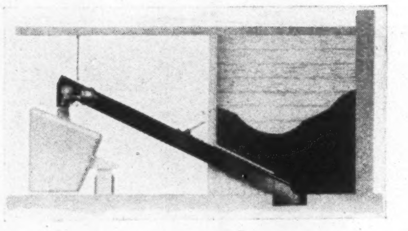
Blower Has Movable Scrolls



No. 1608—New type "UN" direct drive blowers incorporate a flexible scroll mounting, making it possible to adjust the scrolls to any of four standard angles of discharge. The change can be made in but a few minutes, states the maker, who says that this new feature greatly increases the application of these blowers in the air conditioning, warm air heating, and ventilating fields.

Two dynamically and statically balanced squirrel cage type wheels are mounted directly on the shaft of a quiet operating capacitor motor, which can be supplied for one, two or three speed operation.—Peerless Electric Co., 1401 W. Market St., Warren, Ohio.

Loader for Stoker Hoppers

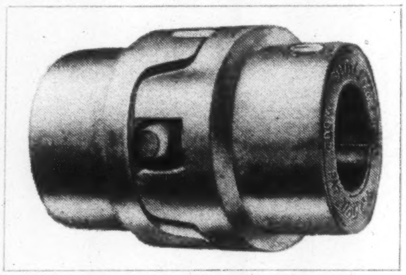


No. 1609—An automatic loader to fill stoker hoppers has a capacity up to 10 tons of coal per hour, and can be adjusted to meet stoker room requirements; the distance from the coal pile only governs the length of the loader.

The model suspended from the ceiling is illustrated, but it can be supported by a stand from the floor, if desired, and can also be furnished for right or left-hand operation. It uses electricity only the few minutes necessary to fill the stoker hopper, and is equipped with 1½ hp motor.

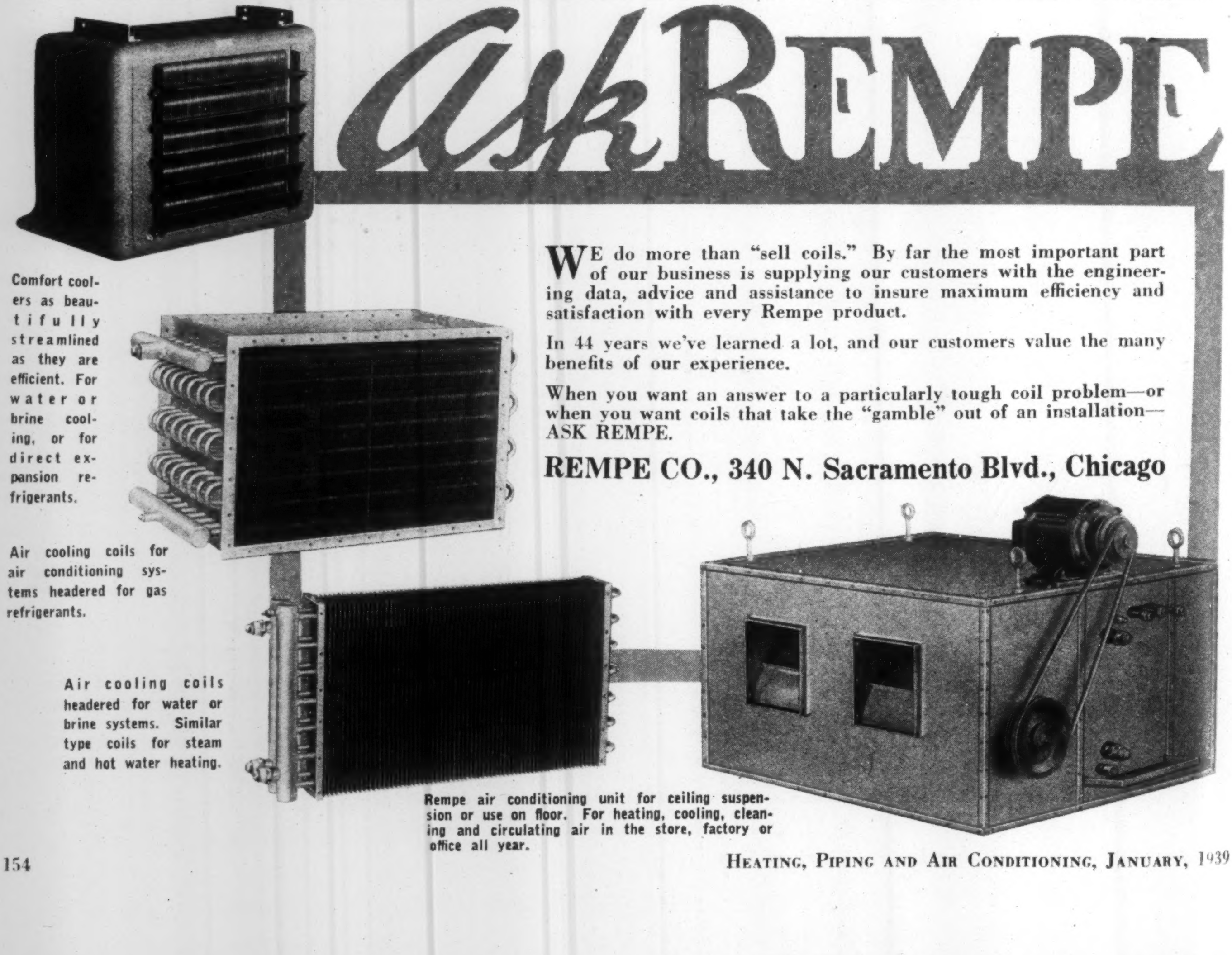
It has been especially designed for use in modern office and public buildings, industrial plants, etc.—D. J. Murray Mfg. Co., Wausau, Wis.

Flexible Couplings



No. 1610—Among the features of the new "Wood" flexible couplings are hardened steel, canvas Bakelite, or rubber replaceable jaws which prevent the possibility of replacing coupling halves, according to the manufacturer. The center section is reversible to provide double wear.

Advantages offered include parallel or lateral displacement of shafts up to 0.0625 in. without impairing the efficiency of the coupling, and angular displacement of at least 10 deg without effect on couplings or bearings. The unit is resilient to take up sudden shock loads as well as starting and stopping loads. Various types are available in a range from ¼ to 7½ hp.—Shallcross Co., 48th and Grays Ferry Rd., Philadelphia, Pa.



Comfort coolers as beautifully streamlined as they are efficient. For water or brine cooling, or for direct expansion refrigerants.

Air cooling coils for air conditioning systems headered for gas refrigerants.

Air cooling coils headered for water or brine systems. Similar type coils for steam and hot water heating.

WE do more than "sell coils." By far the most important part of our business is supplying our customers with the engineering data, advice and assistance to insure maximum efficiency and satisfaction with every Rempe product.

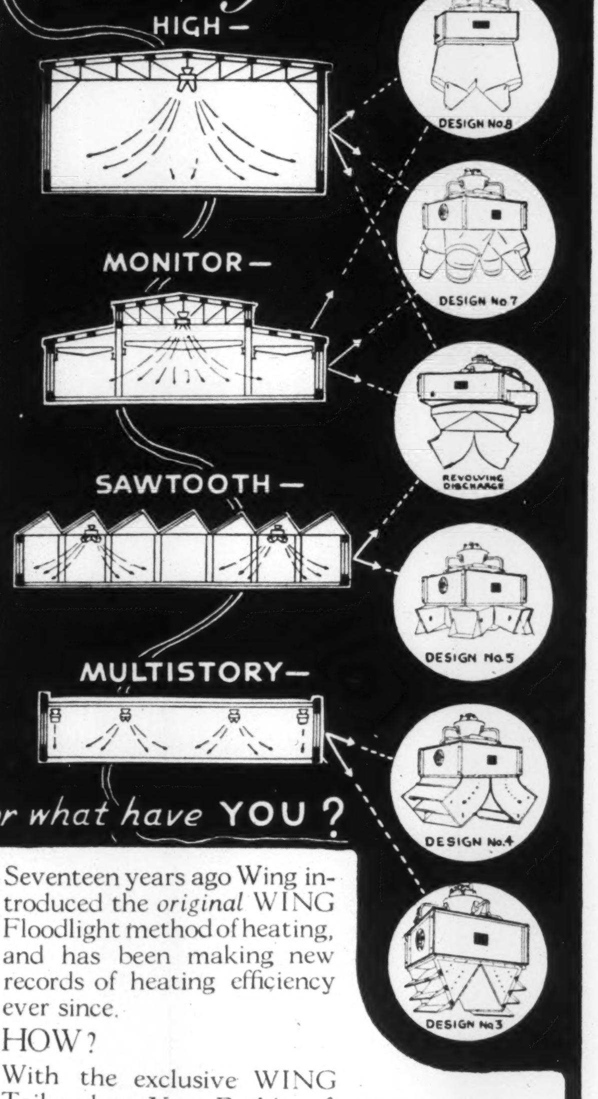
In 44 years we've learned a lot, and our customers value the many benefits of our experience.

When you want an answer to a particularly tough coil problem—or when you want coils that take the "gamble" out of an installation—ASK REMPE.

REMPE CO., 340 N. Sacramento Blvd., Chicago

Rempe air conditioning unit for ceiling suspension or use on floor. For heating, cooling, cleaning and circulating air in the store, factory or office all year.

Tailored-To-Your-Building HEATERS!



Seventeen years ago Wing introduced the *original* WING Floodlight method of heating, and has been making new records of heating efficiency ever since.

HOW?

With the exclusive WING Tailored-to-Your-Building features.

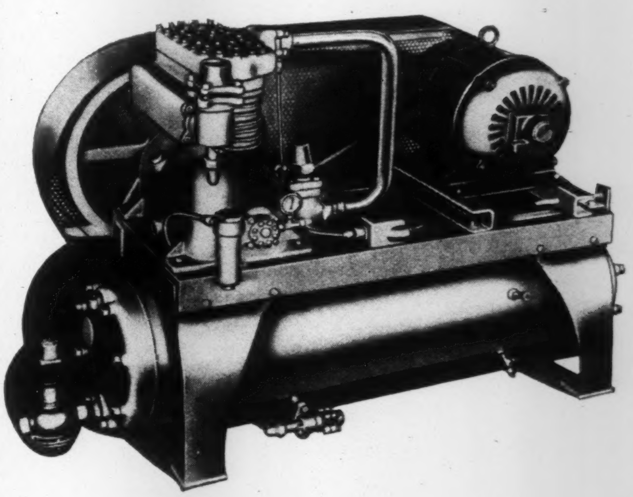
The WING Featherweight Unit Heater is the *Only* heater that offers discharge outlets specifically designed to YOUR particular building conditions, and assures you the most effective heat projection, distribution, and diffusion at lowest cost.

Write today for Bulletin No. H-6A.

L. J. Wing Mfg. Co.

(The Pioneer of Ceiling-Suspended and Lightweight Unit Heaters
14TH STREET AND 7TH AVE., NEW YORK, N. Y.

Wing *Featherweight*
UNIT HEATERS
Floodlights of Heat



. . . by Appointment to
Leading MANUFACTURERS

For 17 years, Universal Cooler has been building electric refrigerating machines.

We are pioneers in the policy of selling commercial refrigerating and air conditioning units exclusively to other manufacturers.

Quietly, and without "ballyhoo" we have secured and maintained a position as the leading supplier of condensing units "by appointment" to some of the largest and best known manufacturers in the industry . . . conclusive evidence that ***architects*** and ***consulting engineers*** may specify condensing units manufactured by Universal Cooler with complete confidence in their performance and dependability.

Universal Cooler products are available to ***heating and ventilating contractors*** through many experienced and reliable manufacturers of refrigerating and air conditioning equipment.

We will be glad to send complete information on request.

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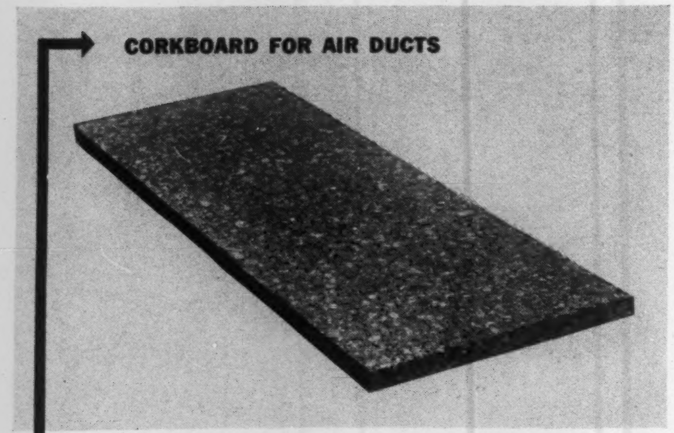
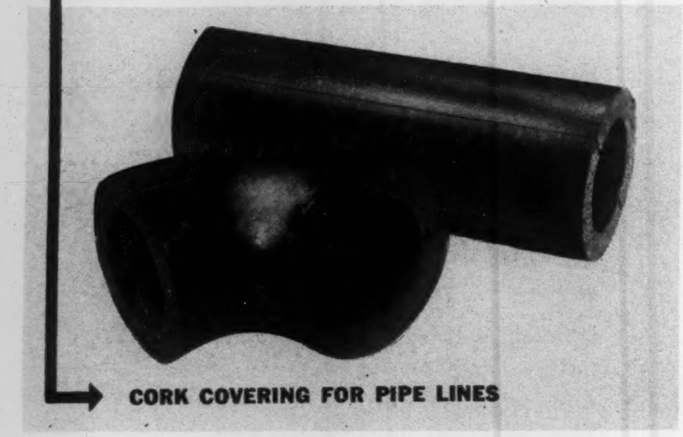
DETROIT, MICHIGAN

In Canada: Universal Cooler Co. of Canada Ltd.
Brantford, Ontario



Check **AIR CONDITIONING LOSSES 2 WAYS** *with* **NOVOID**



YOU DOUBLE-CHECK air conditioning losses when you insulate with Novoid. For this pure cork material provides economical and lasting protection for BOTH air ducts and pipe lines.

In Corkboard form, Novoid is ideal for insulating square and rectangular cold-air ducts. And it prevents heat transfer at air washers, dehumidifiers, and connections. In the form of Cork Covering, Novoid is equally efficient for insulating cold water risers, return lines, and attendant air conditioning piping.

Let Novoid Cork Insulation help you save air conditioning dollars. For more complete details, mail the coupon below. Cork Import Corporation, 330 West 42nd Street, New York City.

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Please send me complete details of Novoid Corkboard and Cork Pipe Covering for air conditioning systems.

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Conventions and Expositions

Refrigeration and Air Conditioning Accessories Exhibition: January 16-19, Stevens Hotel, Chicago, Ill. Manager and Committee Secretary, R. M. McClure, 111 W. Washington St., Chicago, Ill.

Industrial Unit Heater Association: Annual meeting, January 23, William Penn Hotel, Pittsburgh, Pa. Secretary-Treasurer, L. O. Monroe, 5-208 General Motors Bldg., Detroit, Mich.

American Society of Heating and Ventilating Engineers: Annual meeting, January 23-26, William Penn Hotel, Pittsburgh, Pa. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Louisiana Engineering Society: Annual meeting, February 23-25, St. Charles Hotel, New Orleans, La. Secretary-Treasurer, A. M. Hill, 422 St. Charles Hotel, New Orleans, La.

American Society of Mechanical Engineers: Spring meeting, February 23-25, New Orleans, La. Headquarters office, 29 W. 39th St., New York, N. Y.

Air Conditioning Conference: March 8-9, University of Illinois, Urbana, Ill. Sponsored by Department of Mechanical Engineering and the Engineering Experiment Station. Chairman, Prof. W. H. Severns, University of Illinois, Urbana, Ill.

International Acetylene Association: Annual convention, March 8-10, Rice Hotel, Houston, Texas. Headquarters office, 205 E. 42nd St., New York, N. Y.

American Society of Refrigerating Engineers: Spring meeting, May 22-23, Hotel Hershey, Hershey, Pa. Headquarters office, 37 W. 39th St., New York, N. Y.

Association of Gas Appliance and Equipment Manufacturers: Annual convention, May 24-26, Roosevelt Hotel, New York, N. Y. Headquarters office, 60 E. 42nd St., New York, N. Y.

Heating, Piping and Air Conditioning Contractors National Association: 50th annual convention, May 31-June 2, Drake Hotel, Chicago, Ill. Headquarters office, 1250 Sixth Ave., New York, N. Y.

Smoke Prevention Association: Annual convention and exhibit, June 13-16, Hotel Schroeder, Milwaukee, Wis. Headquarters office, 139 N. Clark St., Chicago, Ill.

National District Heating Association: Annual convention, June 27-30, Hotel Pennsylvania, New York, N. Y. Headquarters office, 1317 Spruce St., Philadelphia, Pa.

International Acetylene Congress: 13th International Congress of Carbide, Acetylene, Oxy-Acetylene Welding and Allied Industries, June 25-July 1, Munich, Germany. International Acetylene Association, 30 E. 42nd St., New York, N. Y.

American Society of Mechanical Engineers: Semi-annual meeting, week of July 10, San Francisco, Calif. Headquarters office, 29 W. 39th St., New York, N. Y.

American Society of Mechanical Engineers: Fall meeting, week of September 4, New York, N. Y. Headquarters office, 29 W. 39th St., New York, N. Y.

Booklets, Reports and Papers

Issues Bulletins on Identifying Industrial Dusts, Determining Lead in Air

Two new bulletins outlining "how" measures for combating industrial disease and for guarding employee health are being distributed by the Air Hygiene Foundation, 4400 Fifth Ave., Pittsburgh, Pa., to its member companies. One deals with determination of lead in the air, a metal which alone or in com-

Stop VIBRATION NOISE

in Compressor Lines

Rex Vibra-Sorbers absorb vibration, stop noise, insure permanently quiet operation. Sweated into the compressor lines, they act as flexible couplings for speedy, trouble-free installation. All sizes available.

VIBRA-SORBERS

Made by
CHICAGO METAL HOSE CORPORATION
Maywood, Illinois

G&O RADIATION

FINNED COILS

G&O FINNED RADIATION COILS for all industrial applications are available in a wide range of sizes, for high and low pressure operation.

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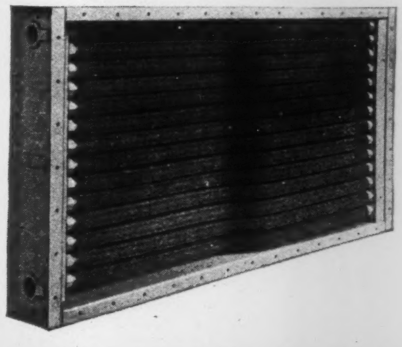

THE G&O MANUFACTURING COMPANY
New Haven, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States

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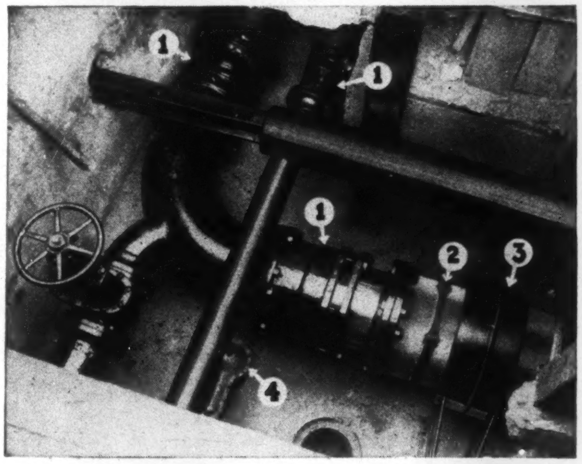
ADSCO INTERNALLY GUIDED JOINT



Typical manhole installation of (1) ADSCO INTERNALLY GUIDED JOINTS — compact and accessible, (2) ADSCO INSULATION SUPPORT, (3) ADSCO ALIGNMENT GUIDE and (4) EMPIRE STEAM TRAP — four dependable ADSCO "MATCHED UNITS" more fully described in Catalog No. 35HP. Write for your copy today.

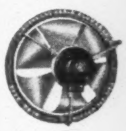
AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS

AUTOVENT

"The Complete Line"

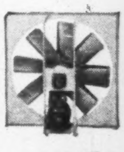
"31 Series" PROPELLER FANS

Exclusive AUTOVENT non-overloading and non-churning propeller fans. Sturdy, economical, efficient, certified ratings. Sizes 9″ to 72″ diameter. Also acid-moisture proof and vapor-explosion proof units. Write for bulletins Nos. 200, 201.



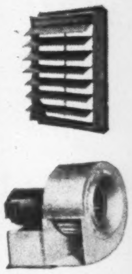
"B W" (*Bucket Wheel*) PROPELLER FANS

When occasion demands a bucket wheel type propeller fan—be sure to specify AUTOVENT. Superior materials, workmanship and certified ratings. Write for bulletin No. 202.



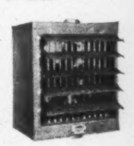
COOLVENT *System of* VENTILATION

A ventilating system that does a real comfort cooling job with large volumes of air. Inexpensive, economical, quiet operating. Built for years of trouble-free service! Certified ratings! Write for bulletin No. 204A.



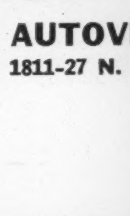
***Automatic* LOUVRES**

Special AUTOVENT design provides weather protection for propeller fan equipment. Sturdy construction; automatic operation; available in rectangular or round styles. A size for every requirement. Write for bulletin No. 205.



VOLUME BLOWERS

For economical, long-lived ventilating service install AUTOVENT UNIBLADE VOLUME BLOWERS. "The Complete Line" consists of all size variations and universal discharges. Wheels from 6″ to 75″ diameter. Certified ratings. Write for bulletin Nos. 300, 301 and 302.



UNIT HEATERS

Eliminate cold spots—force warm air to floor level where needed! Solves many a difficult heating problem. Available in steam or electric units. Write for bulletin Nos. 102, 400.

[AUTOVENT equipment is tested and rated in accordance with standard test code adopted jointly by Nat'l Ass'n of Fan Mfgrs., and Amer. Soc. of Heat. & Vent. Eng's.]

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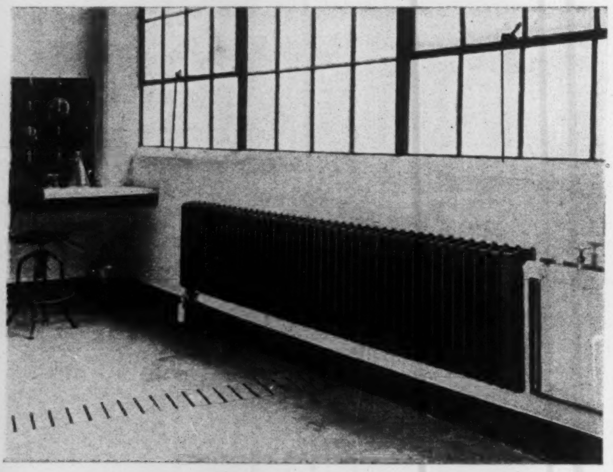
Perkins Radiator operating on high pressure steam in the Pittsburgh laboratory of the American Cyanamid & Chemical Corporation.

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Operate on all pressures up to 150 lb. Combine the most advantageous features of convector—radiator—and unit heater. Approximate unit heater performance in air movement, while delivering a desirable proportion of radiant heat. At elevated steam pressures the surface temperatures are lower than those of the conventional exposed types operating on low-pressure steam.

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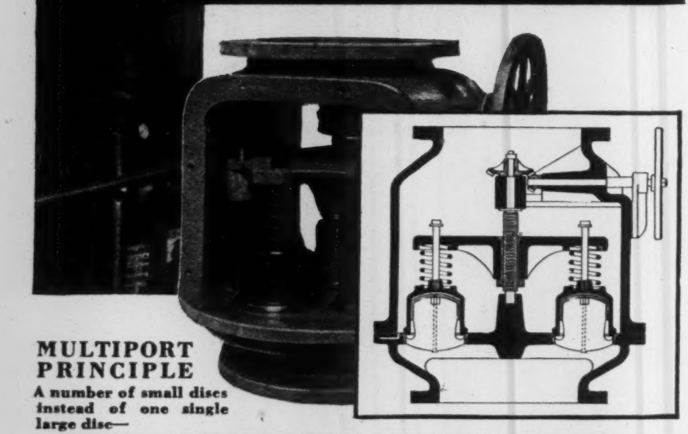
Cannot Stick, Jam or Freeze


MULTIPORT PRINCIPLE

A number of small discs instead of one single large disc—

INSURES CONTINUOUSLY RELIABLE OPERATION

COCHRANE MULTIPORT RELIEF VALVE

The Cochrane Multiport Valve, for the control of atmospheric relief, back pressure, flow or check valve service, uses a multiplicity of small valve discs. These fit tightly against seats, yet are released freely; no possibility of jamming or freezing—no tendency for chatter or seat-pounding.

These valves are especially valuable for steam condenser service where positive tightness under high vacuum is vital. They are giving protection in more than 12,000 plants. If *you* want absolute insurance against damages from relief valves that now stick or jam, install Cochrane Multiport Valves. Write for copy of 16-page Publication No. 2710.

Cochrane Corporation, 3131 N. 17th St., Philadelphia, Pa.

COCHRANE

VALVES · TRAPS · SEPARATORS · SPECIALTIES

bination constitutes a threat to health of workmen exposed as it and its compounds can be inhaled, swallowed, or absorbed through the skin. The other publication is a guide for appraising dust risks.

The first bulletin explains that lead dusts, fumes, and mists may be dispersed in air when using or processing lead, its alloys, or compounds. Methods are described for sampling air to check the presence of lead. The report states that: "Since minute quantities of lead are sufficient to contaminate air, a large enough sample must be taken to provide a quantity of lead within the effective range of the microchemical method used for analysis. Usually, the lead from 30 to 45 cu ft of air is sufficient. This is not a fixed quantity, but depends upon a particular operation.

"It is often important to determine qualitatively the presence or absence of lead in dust samples, in raw materials, such as paint pigments, glazes, enamels, etc., or in excreta."

The bulletin on identification of industrial dusts, states: "The inorganic materials found in industrial dusts are largely minerals, although many artificial substances are also encountered. Chemical analyses of mixtures of such materials seldom reveal the percentages of the various minerals present. However, each mineral has characteristic optical properties that can be determined microscopically with the aid of polarized light.

"This method of identifying minerals by their optical properties is known as optical mineralogy. The identification of industrial dust is accomplished best by using petrography as the basis of analytical work and supplementing it whenever necessary with chemical determinations."

Characteristics of a few minerals commonly found in dust are listed. Dusts are classified in four general groups for purposes of identification: (a) Those composed chiefly of soluble minerals (limestone, parting compounds, fertilizer, etc.). (b) Those composed chiefly of organic minerals (wood, tobacco, leather, grain, etc.). (c) Those composed chiefly of insoluble and inorganic materials (granite, foundry materials, tile and brick, abrasives, etc.). (d) Those composed chiefly of metals or their compounds (lead, manganese, etc.). Dusts in this group are easiest to identify. Under the microscope they are usually opaque.

The bulletins are part of a series prepared by the preventive engineering committee of the Air Hygiene Foundation, of which committee Prof. Philip Drinker of Harvard is chairman. Others issued last year include, "Determination of Benzol Vapor," "Use and Care of Respirators," "Determination of Chlorinated Hydrocarbon Vapor," "Design of Exhaust Hoods," and "Design of Duct Work for Exhaust Systems." The next will cover sampling for the control of atmospheric impurities.

The reports are for the use of the industrial concerns supporting the foundation, a non-profit, scientific organization with headquarters at Mellon Institute. Its purpose is the prevention of occupational disease and the protection of industrial health.

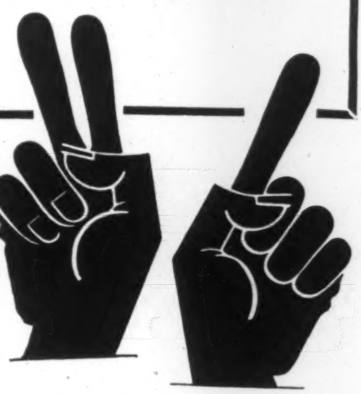
Air Conditioning a Remedy for Rheumatism

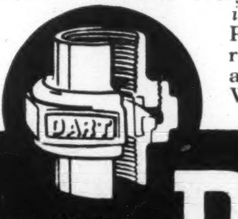
Addressing the annual convention of the American Society of Refrigerating Engineers in New York City last month, Dr. Albert G. Young, medical director of the Corey Hill hospital in Brookline, Mass., said his studies showed no recurrent attacks of rheumatic fever among patients who have entered that hospital since it was equipped with a complete air conditioning system two years ago.

"Patients suffering from arthritis or rheumatic fever are notorious weather prophets, and very accurate ones too," Dr. Young pointed out. "This is sufficient evidence in itself that temperature and humidity play a part in rheumatic diseases."

These diseases occur most commonly where there is a damp changeable climate—in this country along the Atlantic coast from Maine to Baltimore, in the Great Lakes region, the Mississippi valley, and on the Pacific coast from Seattle to San Francisco.

"In any form, rheumatism usually becomes chronic, and even





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Any Dart that doesn't make good on the job we'll make *doubly good.* We'll replace it two for one. We're safe in making this guarantee because Darts have two bronze seats accurately ground to a true ball joint—a joint that assures permanent tightness under repeated use, and gives you *lower cost per tight joint.* Because Dart air-refined malleable iron bodies and nuts withstand pipe strains, wrench abuse, corrosion. Because every single Dart is factory-tested *individually.* Add up the facts. Put your money on Darts, for repeated tightness on the line and lower cost on the books. Write for one to try.

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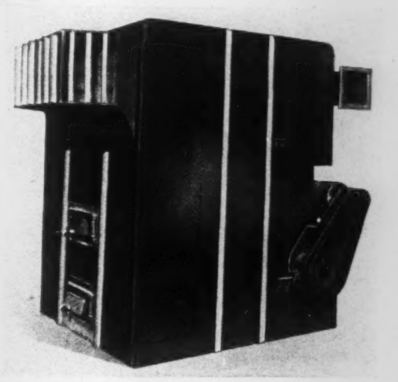
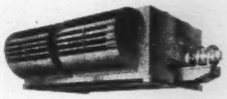
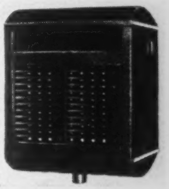
E. M. DART MFG. CO., PROVIDENCE, R. I.







AIRTHERM Announces the DIRECTHERM

Direct-Fired Unit Heaters for Gas, Oil or Coal Firing
(Stoker or Hand)

●

The DIRECTHERM is the most flexible heating unit available on the market today. It provides efficient, economical heating service at low initial cost.

These units require nothing more than a stack and electrical connection, and can be made fully automatic in operation. Available in six standard sizes from 350,000 to 1,500,000 BTU's. Write for Bulletin No. 305.

THE AIRBLANKET

... The new style of unit heater with a patented and exclusive method of air direction control. Especially suited for high ceiling jobs. Available in centrifugal fan types and propellor fan types. Ask for Bulletin No. 210.

AIRTHERM UNIT HEATERS ... Available in a full range of standard capacities, either propellor fan (THE AIRVECTOR) or centrifugal (THE AIRHEATOR) types. Many exclusive features in this thirty-year old line.

AIRTHERM MANUFACTURING CO.
1478 S. Vandeventer Ave., St. Louis, Mo.

EXTREMES

A 4½" bellows capable of 1¾" movement; and a 15/32" bellows capable of 350 lbs. pressure per square inch.

HYDRON Metallic Bellows

HYDRON Metallic Bellows are used as control elements in temperature-and-pressure-control devices, and for liquid or gas seals of compressors and pumps. We are specialists in the design and production of complete thermostatic and pressure units for temperature and pressure controls. We are, therefore, prepared to extend the fullest co-operation to engineering departments of control manufacturers in the solution of design and engineering problems.

Write for 44-page Engineers' Data Book.

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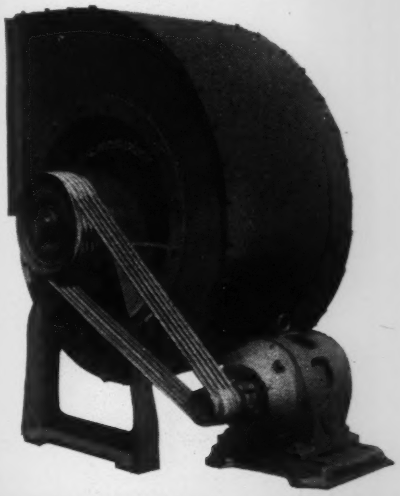
BOSTON CHICAGO DETROIT LOS ANGELES
PRODUCERS OF BELLOWS EXCLUSIVELY SERVING AUTOMATIC CONTROL MANUFACTURERS



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For circulating hot gases in ovens, dryers or furnaces, temperatures to 1600 degrees F.
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Patterson **Freon Water Coolers**

Patterson Water Coolers are the peak of mechanical excellence achieved through more than half a century of experience in heat transfer equipment.

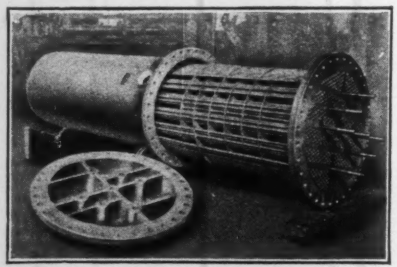
They offer the most efficient and economical method of cooling water in closed or open circuits with Freon or similar refrigerants.

Patterson Coolers insure the proper operation of the thermo expansion valve by always delivering superheated gas to the suction line. The U-tube construction eliminates all possibility of leaks from expansion and contraction and permits easy removal of the entire tube bundle.

Patterson Coolers are divided into as many circuits as there are compressors so as to provide permanent segregation of refrigerant charges for each compressor.

For further particulars write for catalog.

THE PATTERSON-KELLEY CO., INC.
107 WARREN STREET EAST STROUDSBURG, PA.



the patient who becomes symptom-free is subject to recurrent attacks. In children and adolescents it usually assumes the form of rheumatic fever, while in adult life it usually affects the joints only and is known as arthritis."

Dr. Young cited studies of the American Heart Association showing that rheumatic fever is responsible for 95 per cent of the defective hearts in childhood and accounts for more than a third of the crippled hearts in adult life. It causes at least 40,000 deaths in the United States, at an average age of 30 years.

"So far medical treatment has been very unsatisfactory," he reported. "It consists of removal of focal infection and bed rest for prolonged periods, plus a warm dry climate. It is extremely expensive to move rheumatic fever patients to the South or Southwest, moreover they are susceptible to recurrent attacks on their return.

"The first attack of rheumatic fever seldom produces irreparable heart damage. It is the recurrent attacks that finally lead to injury of the heart valves. In cases treated at the Corey Hill hospital we have been able to forestall recurrent attacks, and none of the patients developed demonstrable valvular lesions," he said.

Through air conditioning it is now possible to produce the optimum conditions for these patients in every community, he asserted, and predicted that the cost would be offset by the shorter period of time necessary for recovery.

Air Conditioning Books and Codes

To answer requests for sources of information on air conditioning, a list of recent books on air conditioning, with particulars as to their contents, publishers and prices, has been compiled by the research plans and publications section of the National Research Council, Ottawa, Canada, and may be obtained from that office at 25c per copy. The list is believed to contain the majority of the books dealing specifically with comfort air conditioning that have appeared in the last two years.

Standardization of practice in air conditioning is being brought about through the adoption of codes by municipalities, engineering organizations and others interested in this field. A compilation of conditioning codes has also been made by the Council and copies will be available soon at 25c each. This publication should be of use to those contemplating the establishment of codes by providing a ready reference to what has already been done in this field, the Council believes.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 164. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 3025. BLOW-OFF VALVES: Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa. 24 p. bulletin (B-420) on blow-off valves for low and medium pressure boilers, giving descriptions of various types, construction details, prices, weights, dimensions and physical and chemical properties of metals in the valves and illustrating various installations. Also a similar 24 p. bulletin (B-430) on blow-off valves for high pressure boilers. Recent changes and improvements in these "Yarway" valves are covered in these new catalogs.

No. 3026. BOILERS: Kewanee Boiler Corp., Kewanee, Ill. 24 p. general catalog (80f) covering full line of steel boilers, giving in compact form specification data for every size of all models. Both hand fired and mechanically fired units are included.

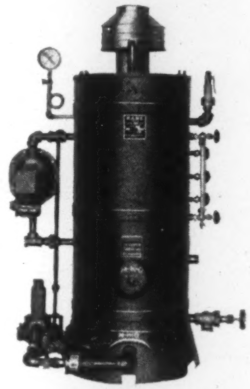
Of all Boilers over 1 H.P.—all available figures show . . . .

THERE ARE MORE KANE BOILERS IN USE TODAY THAN ANY OTHER MAKE!

Such universal preference must be deserved! And PERFORMANCE is the answer! Performance that holds steam costs to an irreducible minimum . . . performance that saves human time and labor, as well as money . . . performance that never varies through long years of constant use.

Its attested performance, too . . . guaranteed by the maker . . . and proven practically by its record in actual use!

Certified field check-ups and comments of users will prove KANE superiority to you. Examine this data, it's yours upon request . . . and you'll profit by it!



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Executive Offices and Factory
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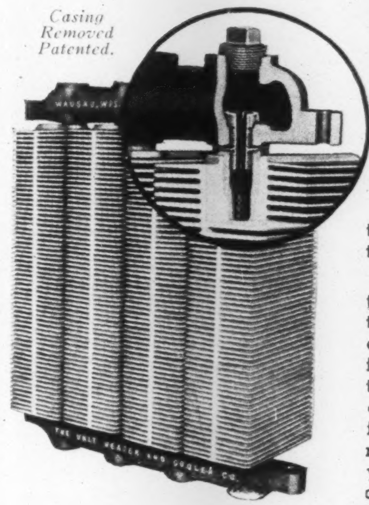
This **IS WHY THE GRID UNIT HEATER** *is different*



This enlarged cutaway section shows what we mean when we say "no two dissimilar metals in contact with steam. Therefore no electrolytic action—no breakdowns due to corrosion."

Note the free area of the cast aluminum radiation surface, this prevents clogging with dust, lint, fumes, etc. Grid is distinctive among unit heaters—designed and made for long service without maintenance. Let us send you complete details and capacity tables.

The Unit Heater & Cooler Co.
Offices in all principal cities. Wausau, Wisconsin

GRID UNIT HEATER

DEPENDABLE

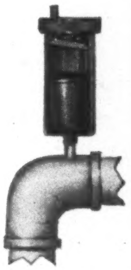
AUTOMATIC

Air Vents • Humidifiers

You will find in MAID-O'-MIST, a complete line.

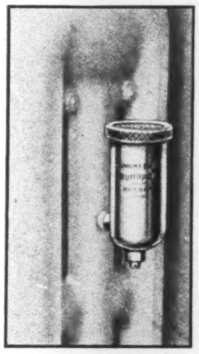
Automatic Humidifiers for warm air, steam and hot water heating systems.

Automatic Air Vents for hot and cold water circulating lines, cooling units and hot water radiators.



The No. 7 Auto-Vent
Vents that high spot in the line or the concealed radiator and insures perfect circulation.

Send Today for Free Catalog H-1.



No. 95 Auto-Vent Humidifier for steam radiators. →
Takes place of air valve. Automatically vents air from radiator and humidifies. Easily adjusted by set screw at bottom of valve. Also made in style V-95 for vapor and vacuum steam heat.

MAID-O'-MIST, Inc.

180 N. Wacker Drive Chicago, Ill.

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AIR CONDITIONING PIPE AND FITTINGS
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You need this valuable data book in your air conditioning business. It will make estimating easier and help you lower the costs of the complete installation . . . and the Moncrief patented lock joints on wall stacks, stack heads, footpieces and trunk duct fittings make a more efficient, neater job that is easier to install.

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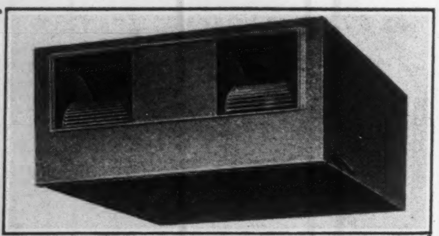
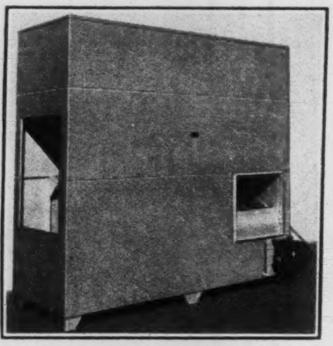
HORIZONTAL OR VERTICAL ALL SEASONS AIR CONDITIONERS.





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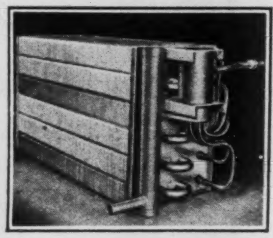

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Williamsburg Houses Project Equipped with *Patterson* Hot Water Heaters

This $12,700,000 project in Brooklyn, N. Y., consists of 20 four-story buildings containing 1,622 apartments and 44 stores. Ten heating plants supply the steam and hot water.

The Patterson Hot Water Heaters in these buildings assure tenants of all the hot water required, as hot as required and as quickly as required.

No greater testimonial could be extended to Patterson Heaters than their selection for this gigantic project.

WRITE FOR CATALOG

The Patterson-Kelley Co., Inc.
107 Warren Street East Stroudsburg, Pa.

No. 3027. BRAZING ALLOYS: Handy & Harman, 82 Fulton St., New York, N. Y. 1 p. bulletin (11) on brazing cemented carbide tool tips with "Easy-Flo" brazing alloy, giving in detail the procedure to follow.

No. 3028. CONVECTORS: Commodore Heaters Corp., 11 W. 42nd St., New York, N. Y. 2 p. data sheet (Form 667) on "Convectofin" room heating convectors, describing features and giving dimensions. Also a leaflet showing these convectors for single pipe steam heating, two pipe connection, and hot water heating.

No. 3029. COPPER WATER TUBE: Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y. 12 p. folder giving pertinent data and specification material on copper water tube, including information on physical properties, available types, general advantages, installation data, fittings, tables to determine sizes, standard dimensions, weights and properties, and typical specifications.

No. 3030. FLEXIBLE METAL HOSE: Flexible Metal Hose and Tubing Institute, 150 Broadway, New York, N. Y. 19 p. "Fact Book of Flexible Metal Hose and Tubing" presenting a complete story of these products and graphically portraying their wide usefulness in meeting many of industry's design, construction and maintenance problems. The principal types and forms of flexible metal hose and tubing are listed and illustrated and underlying engineering principles are discussed.

No. 3031. HEATING COILS: Bush Mfg. Co., 100 Wellington St., Hartford, Conn. 12 p. bulletin on heating coils (booster unit section) with illustrations of the various types, information on how to select the proper unit, dimensions and physical data, and rating and other pertinent tables and charts.

No. 3032. HUMIDIFYING: Parks-Cramer Co., 970 Main St., Fitchburg, Mass. Issue of "Parks' Parables" devoted to the development of textile humidifying equipment and particularly the contributions of the manufacturer to the improvement of such equipment. Some fifty odd items are treated in an informal and interesting manner.

No. 3033. INSULATION: Cork Insulation Co., Inc., 155 E. 44th St., New York, N. Y. 24 p. booklet on "Corinco" cork insulation products, discussing engineering and erection service; cork and its structural characteristics; how "Corinco" corkboard is manufactured and its uses and advantages; general recommendations for installing corkboard; general specifications for insulating walls and partitions, ceilings and floors, roofs, and freezing tanks; pipe coverings for cold lines; insulation of brine coolers and cylindrical tanks; and machinery isolation corkboard. A chart of heat loss coefficients and various other data are included.

No. 3034. MANOMETERS: Meriam Co., 1955 W. 112th St., Cleveland, Ohio. 50 p. booklet presenting a discussion of the manometer and its uses, by J. B. Meriam. Sketches of many types are shown and the book concludes with conversion tables, instructions for installation and reading, and various tables of engineering data and formulas.

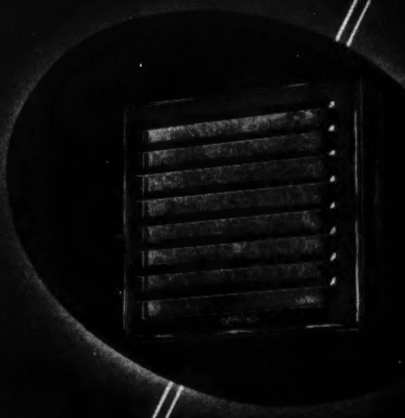
No. 3035. MOTOR STARTERS: General Electric Co., 1 River Rd., Schenectady, N. Y. 6 p. bulletin (GEA-2964) describing a full voltage magnetic starter with series of illustrations showing its features and including dimensions.

No. 3036. ONE PIPE HOT WATER HEATING: H. A. Thrush & Co., Peru, Ind. Data sheet announcing two complete lines of one-pipe fittings for hot water heating systems, one in bronze with sweat fitting connections, and one in cast iron screwed for steel pipe work.

No. 3037. PUMPS: Worthington Pump & Machinery Corp., Harrison, N. J. 4 p. bulletin (W-450-B19C) on two types of deep well turbine pumps, illustrating construction and advantages.

No. 3038. PUMPS: Taber Pump Co., 272 Elm St., Buffalo, N. Y. Series of bulletins on various types of centrifugal pumps, bronze pumps, sump pumps, primer pumps, vertical centrifugal pumps, and rotary pumps for handling various process liquids.

No. 3039. RUST PREVENTION: Parker Rust Proof Co.,



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UNIT HEATERS
ALL PRESSURES
DURABLE QUIET

KRAMER TRENTON AUTO RADIATOR WORKS
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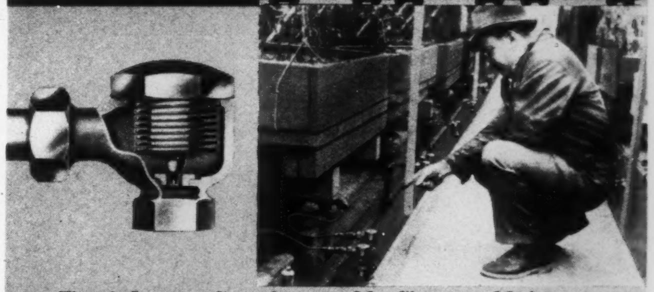
"WE SAVED THREE CARS OF COAL"



Floral Avenue Greenhouses, Mt. Clemens, Michigan, installed 400 Sarco Type H and FT Steam Traps three years ago. They intentionally purchased $800 less coal *and* had three cars left over at the end of the year. "Better heating, absolutely no maintenance difficulties, and Sarco Traps have saved us more than twice their original cost each year."

IF YOU USE STEAM HEAT

Sarco Radiator Traps will give you the same kind of efficiency. Time after time, building managers and contractors tell us that the cost of a changeover to Sarco was saved the first year.

Sarco heating specialties comprise Radiator Traps, Inlet Valves, Main Drip Traps, Air Eliminators, Alternating Receivers and Temperature Control, all made in the new Sarco plant devoted exclusively to this purpose.

Ask for Catalog No. 45 or this new data book.

STEAM HOOK-UPS
53

SARCO THERMOSTATIC FLOAT AND BUCKET TRAPS REGULATORS AND HEATING SPECIALTIES
SARCO COMPANY, INC., 183 MADISON AVENUE, NEW YORK, N.Y.
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AIR CONDITIONING NOZZLES

YARWAY
YARWAY INVOLUTE B

Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

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YARWAY

STANDARDIZE ON SPORLAN CONTROLLED PERFORMANCE VALVES

SPORLAN
Controlled Performance
VALVES

and get "Peak Performance" on ALL installations

Sporlan CONTROLLED PERFORMANCE valves are the only thermostatic expansion valves with elements charged according to the application of the valve. The selective charges are designed to give the best operating characteristics for each class of installation. Only by using SPORLAN valves can you be assured of PEAK performance on EVERY installation.

You can install SPORLAN VALVES WITH CONFIDENCE

SPORLAN Controlled Performance THERMOSTATIC EXPANSION VALVES

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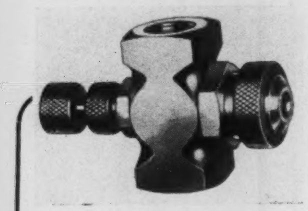

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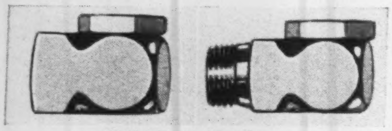
Non-clogging "Whirljet" Nozzles of all sizes and types for every Air Conditioning requirement

Pneumatic Atomizing Nozzle

Atomizing Nozzles Pneumatic or direct Hydraulic for Humidifying



"Whirljet" Nozzles

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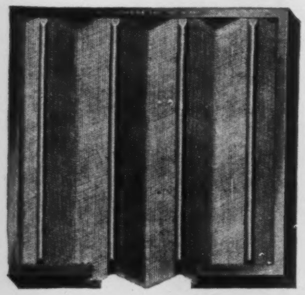
CHICAGO, ILLINOIS
Write for literature.

Lower Air Conditioning Installation costs with Ice Accumulating Evaporators for Storage Refrigeration applications. For information write Carl F. Boester, 101 E. Essex—Kirkwood, St. Louis, Missouri.



Are Your Filters Worn Out?

If so replace with Somers: Indestructible —Washable—Odorless. Made to fit any master holding frame. Give c.f.m. per unit and dimensions of present master holding frame.

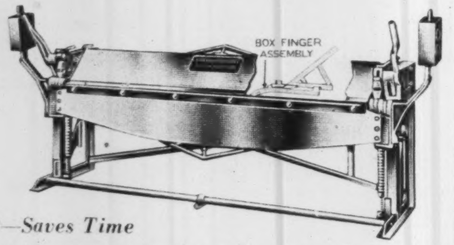
SOMERS
HAIR GLASS
FILTER

A few choice territories available for representatives. Full particulars on application.

H. J. SOMERS, INC., 6065 Wabash Ave., Detroit, Mich.

BENDING BRAKES **WHITNEY-JENSEN** METAL TOOLS

ROLLER BEARING BENDING BRAKE EASIER TO WORK



Reduces Effort—Saves Time

Users are enthusiastic about how much easier it is to handle the Whitney-Jensen ROLLER BEARING Bending Brake. We urge you to try one at the first opportunity—and see for yourself!

WHITNEY METAL TOOL CO. • 180 Forbes St., Rockford, Illinois

Heating, Piping and Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [1-3

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle numbers in which you are interested):

1589 1590 1591 1592 1593 1594 1595
1596 1597 1598 1599 1600 1601 1602
1603 1604 1605 1606 1607 1608 1609
1610
3025 3026 3027 3028 3029 3030 3031
3032 3033 3034 3035 3036 3037 3038
3039 3040 3041 3042 3043 3044 3045
3046

Name.................................... Title..........

Company ....

Address ....

City.................................... State........

Detroit, Mich. 24 p. booklet on "Parkerizing" rust prevention for iron and steel, describing the process and its advantages, showing types of products on which it is used, and describing and illustrating the facilities of the organization.

No. 3040. SWITCHGEAR: General Electric Co., 1 River Rd., Schenectady, N. Y. 24 p. bulletin (GEA-2872) discussing "what every plant operator should know" about metal enclosed switchgear, illustrating eight principal types and showing these types and their various features.

No. 3041. TRAPS: Hoffman Specialty Co., Inc., Waterbury National Bank Bldg., Waterbury, Conn. Circular showing cross section photographs of the manufacturer's traps and featuring the thirteen features and "double life construction" of the "50 Series" traps which are available as combination mechanical float and thermostatic traps or as mechanical traps.

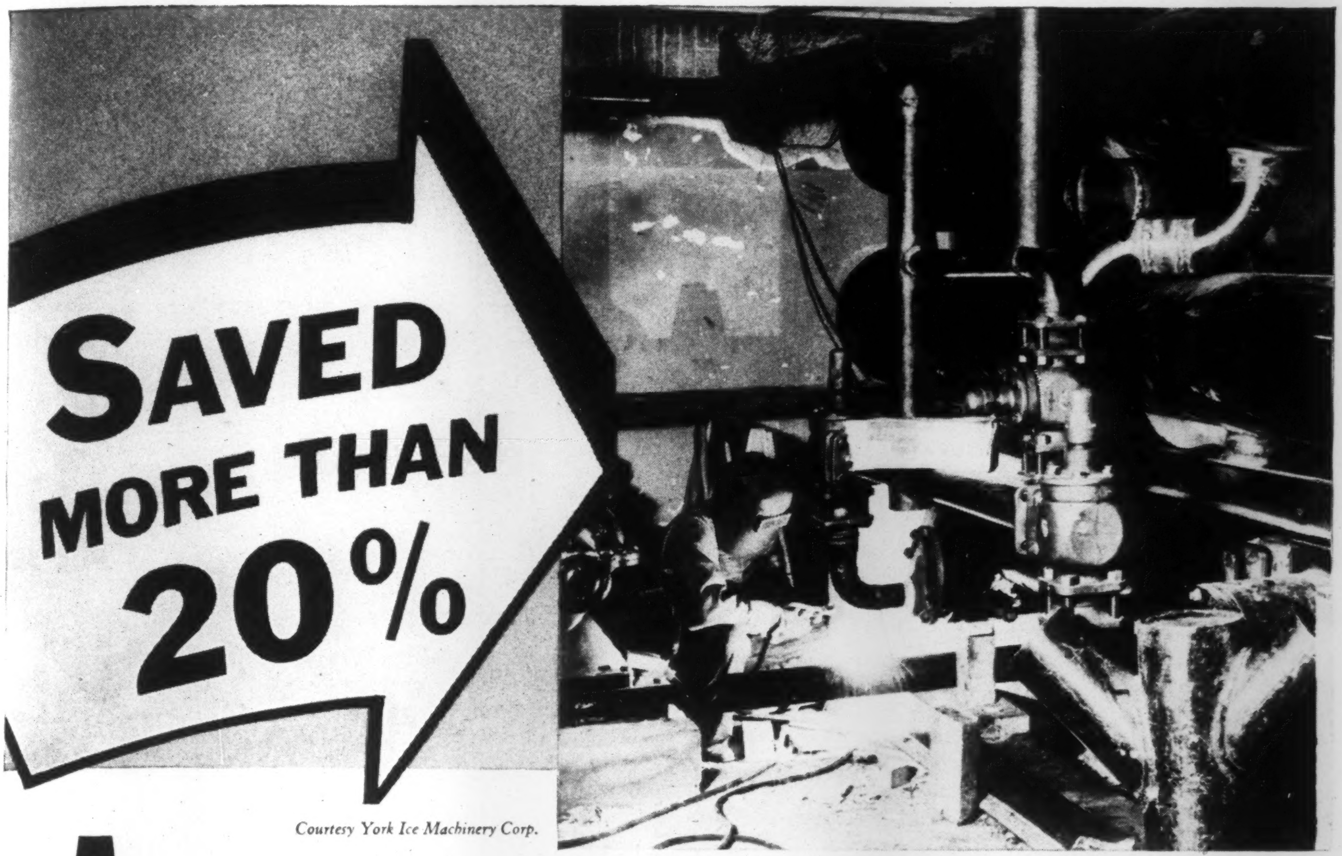
No. 3042. UNIT HEATERS: Economy Electric Mfg. Co., 4606 W. 21st Pl., Chicago, Ill. 4 p. bulletin (300) on this manufacturer's unit heaters, describing their construction and advantages and giving dimensions and performance data.

No. 3043. VALVE MATERIALS: Edward Valve & Mfg. Co., Inc., 1200 W. 145th St., East Chicago, Ind. 4 p. issue of "Valve Values" including information on blow-off valve materials, valves for the oil industry, studies of corrosion and non-return and stop valves.

No. 3044. WATER GAGE ILLUMINATORS: Wright Austin Co., 315 W. Woodbridge St., Detroit, Mich. Circular describing new neon water gage illuminator which is installed behind gage glass and which makes any water gage easier to read, according to the manufacturer. It illuminates the entire length of the gage glass, but the water or liquid filled portion is magnified and appears as a broad bright red band the full length of the glass, while in the steam space above appears only a narrow stripe of red.

No. 3045. WELDING AND CUTTING APPARATUS: Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y. 30 p. catalog (22) on welding and cutting apparatus and supplies, with information on hand welding and cutting torches and tips, pressure regulators, fluxes, rods and other supplies. Eight complete outfits covering the entire range of industrial uses are shown and in addition data on portable oxygen and acetylene manifolds, circular cutting attachments, cylinder trucks, torch extensions, etc., are given. Also a 64 p. catalog (21) designed for the large user of oxy-acetylene equipment and electric arc welding machines which has several pages devoted to pipe line safety devices and other items not included in the smaller catalog.

No. 3046. WELDING HOSE: Hewitt Rubber Corp., Buffalo, N. Y. Circular describing new "Twinweld" welding hose, consisting of two lines of flexible cord-reinforced welding hose molded into a single unit that will not kink or writhe, or twist under high pressure. Available in any desired cut length, or in continuous lengths as long as 500 ft that can be cut as needed.



Courtesy York Ice Machinery Corp.

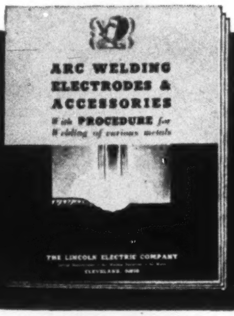
Another air conditioning installation is "Shield-Arc" Welded

• This air conditioning system, installed in a Kansas City, Mo. department store, contains a total of 3400 feet of pipe ranging in size from 1¼ inches to 10 inches. All of the piping was fabricated and erected by arc welding with the world's favorite pipe welding combination—Lincoln *"Shield-Arc"* Welders and Lincoln "Fleetweld" Electrodes. Savings over the other welding process were said to be more than 20%.

Lincoln *"Shield-Arc"* Welding is a money saver for piping because it is exceptionally fast (Bul. 411 gives speeds) and because it uses electric power which is relatively cheap. Consult the nearest Lincoln office or mail the coupon.

THE LINCOLN ELECTRIC COMPANY

Largest Manufacturers of Arc Welding Equipment in the World



ARC WELDING
ELECTRODES &
ACCESSORIES
With PROCEDURE for
Welding of various metals

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

THE LINCOLN ELECTRIC CO., Dept. RR-570, Cleveland, Ohio

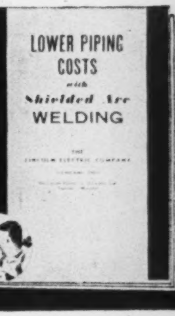
☐ Send a free copy of Piping Bulletin 411. ☐ Send procedure for "Fleetweld 5," the world's favorite electrode for pipe welding.

Name ____________ Position ____________

Company ____________

Address ____________

City ____________ State ____________



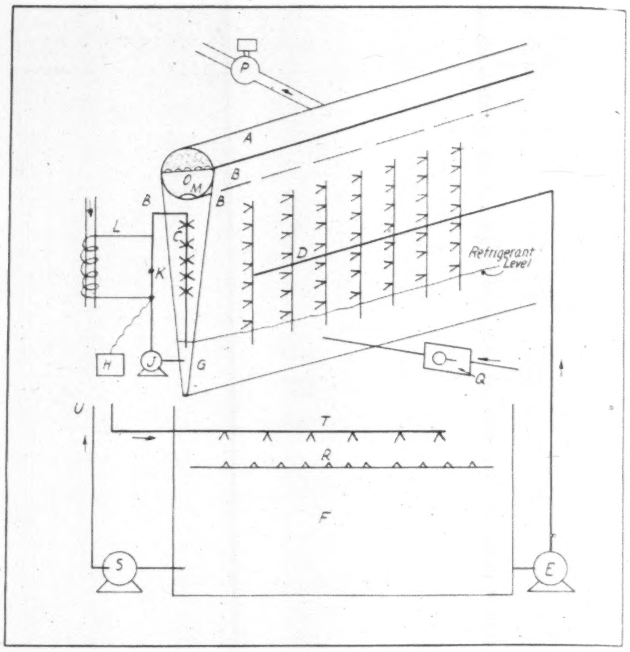
LOWER PIPING
COSTS
with
Shielded Arc
WELDING

THE
LINCOLN ELECTRIC COMPANY

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 126. Add the new products and companies listed here to your Directory Section which you received in your January, 1939, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Plate Type Evaporator Stores Refrigeration for Air Conditioning



No. 1611—A new type of evaporator which has been worked out for the freezing of ice to be accumulated or stored up for use in storage refrigeration applications for air conditioning purposes is shown in the sketch.

The evaporator is usually constructed by using a section of steel pipe or copper tubing *A*, 8 to 10 in. in diameter, the length of which varies according to the evaporator capacity. At mid-point on each side of the cylinder is welded a steel sheet *B*. Both sheets of metal are joined at the bottom as indicated. Inside of this plate type evaporator is a spray nozzle manifold through the nozzles of which the refrigerant used is sprayed. On the outside of the evaporator, along the sides of the plate, water is sprayed from the nozzles of the spray bank *D*. Water is supplied to these nozzles by a water circulating pump *E* drawing water out of an insulated tank *F*. Any water that is not frozen on the evaporator falls back into the tank, where the ice is also deposited.

The refrigerant is withdrawn from the evaporator at *G* by a special "Freon" pump *J* and is circulated over and over through the refrigerant spray bank *C*. Every few minutes, as ice is accumulated on the sides of the evaporator, the timing device *H* operates a three way solenoid valve which diverts the flow of the refrigerant through a heat exchanger, which consists of a length of pipe *L* wrapped around the discharge line between the compressor and the condenser. To make sure that the refrigerant flows in the right direction, a check valve *K* is installed as indicated. By circulating the refrigerant through the heat exchanger, it is warmed and the warm refrigerant is sprayed against the sides of the evaporator loosening the sheet of ice, which falls to the tank below on the pointed grid *R*, which grid breaks the sheet into small pieces that fall into the tank.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

No. 9 of a Series of Curtis Advanced Engineering Features.

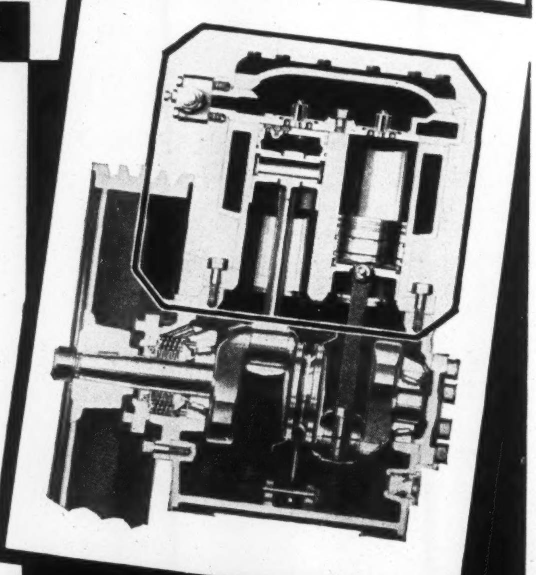
CURTIS Water Jacketed Cylinders Assure Better Lubrication —Increase Efficiency

It costs more to make water jacketed cylinders for Curtis compressors, but good engineering practice demands just such extra refinements in the interests of a fine product.

As in an automobile engine, water jackets keep the cylinders cooler, a prime factor in assuring better lubrication and proper oil consistency. Efficiency is likewise increased, for more gas can be compressed at each stroke of the piston, since cooler gas is of greater density.

In such ways has the outstanding performance record of Curtis compressors and condensing units been developed—a record proven in thousands of installations. Sell Curtis units—available in capacities from 1/6 to 30 H.P., air and water cooled, precision engineered to deliver economical, care-free performance.

Write to Curtis for complete information.



CURTIS

"Builders of Condensing Units Since 1922"

CURTIS REFRIGERATING MACHINE CO.

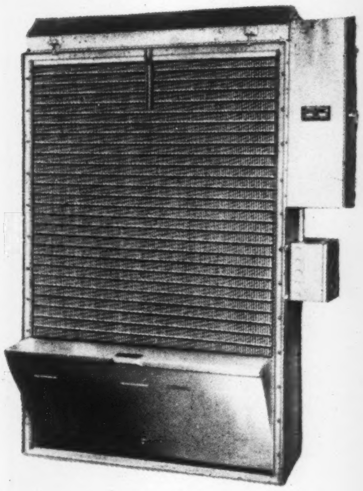
Division of Curtis Manufacturing Co.

1950 KIENLEN AVENUE ST. LOUIS, MO.

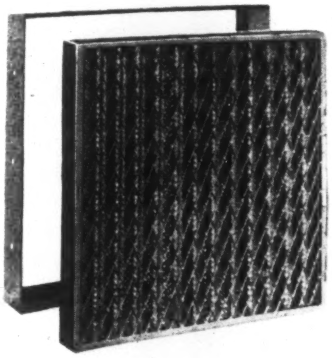
Represented in Canada by
Canadian Curtis Refrigeration Co., Ltd.
20 George St., Hamilton, Ont., Can.

MULTI-PANEL AUTOMATIC

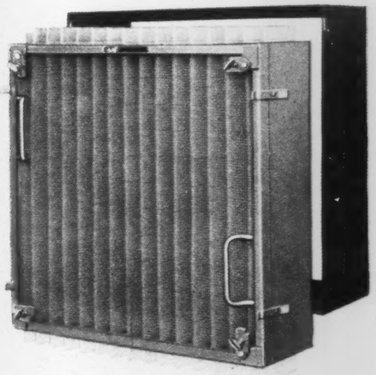
Multi-Panel automatic with the new armored panel for commercial and industrial air conditioning.



Multi-Panel is self-cleaning, fully automatic and provides, with a minimum of attention, constant uniform air supply.



American Unit Filter—M/W-2 for cleaning re-circulated air in central systems; for unit air conditioners and domestic systems.



Airmat Dry Type PL-24—for central air conditioning service. Uses Airmat paper or fibre glass media furnished in rolls.

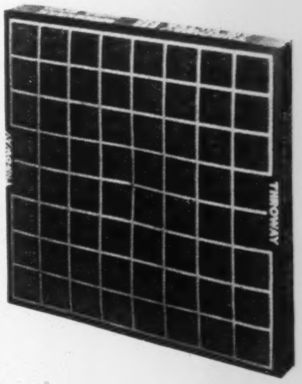
A Filter for Every Domestic and Commercial Air Conditioning Need

The American Air Filter Company offers a complete line of filters engineered to meet every air cleaning requirement.

The 5 filters shown on this page are but a few of the 150 different items offered in the full line of AAF air cleaning and dust control equipment.

Complete engineering data and bulletins descriptive of every AAF filter are available. Information on any specific air cleaning problem will be furnished gladly by our engineering department without obligation.

Washable Type A/C-2 permanent filter for domestic and commercial unit air conditioners. Can be cleaned and re-Visconsined at cost of 5 cents.



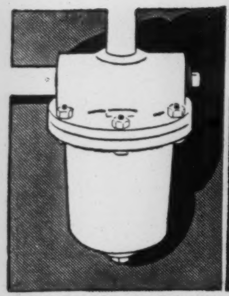
American Throway Renewable Type Filter with cardboard casing is designed to be discarded after it has accumulated its dust load. For unit air conditioners, warm air heating and domestic air conditioning systems.

AMERICAN AIR FILTER CO., Inc.
INCORPORATED
230 Central Ave., Louisville, Ky.
IN CANADA: DARLING BROS., LTD., MONTREAL, P. Q.

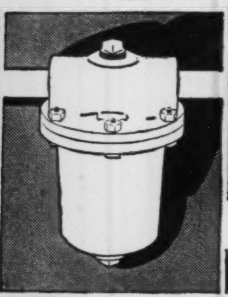
The Symbol of Clean Air

DUST CONTROL AAF **AIR FILTRATION**

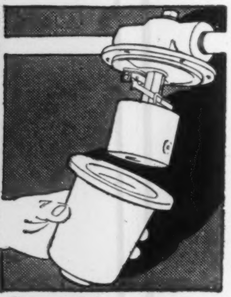
"Now we get
INSTANT HEAT
on every
unit"



Anderson Super-Silvertop steam trap installed as an elbow. Notice simplicity and saving in fittings and labor.



This view shows the same trap installed straight-in-line—same simplicity, same saving in fittings and labor.



Super-Silvertops are easily opened for inspection and cleaning without disturbing pipe connections. This means further savings.

● "There used to be frequent complaints about slow heating, production delays and extra long cooking time around this place—but not any more. Ever since we changed every trap for Anderson Super-Silvertop traps equipped with Thermal Air Eliminators, we get *instant heat* all the time."

Slow heating is usually a sign of an air-bound or water-bound unit. Anderson Super-Silvertops keep the unit drained of condensate and free of entrained air. Air Eliminator equipped Super-Silvertops are designed for installations like the one referred to above, where greater air handling ability is needed.

If you are troubled with slow heating or uneven production, get the facts about these money-saving Anderson traps—they cost no more but they solve more heating problems. Write today for facts and prices.

THE V. D. ANDERSON CO.
1949 West 96th Street • Cleveland, Ohio

Anderson SUPER-SILVERTOP

A valve P in the suction line prevents overloading of the compressor. This is a combination non-overloading valve and stop valve. During the defrosting cycle this valve is also closed by timing device H. The defrosting cycle is a matter of only a few seconds.

The lower half of cylinder A is divided by plate O, below which is a thin stuffing of steel or copper wool. A series of holes is drilled in the bottom portion of cylinder A as indicated by the letter M. There are also a series of perforations in plate O. The metal wool serves to prevent any free drops of refrigerant from being carried over into the high side.

As the refrigerant is condensed, it is re-admitted to the evaporator by a float valve shown at Q. When chilled water is required for the air conditioning system of which this unit is a part, it is withdrawn through pump S, circulated to and returned from the point of use U. Water is sprayed over the ice through spray bank manifold T, thus re-chilling the water.

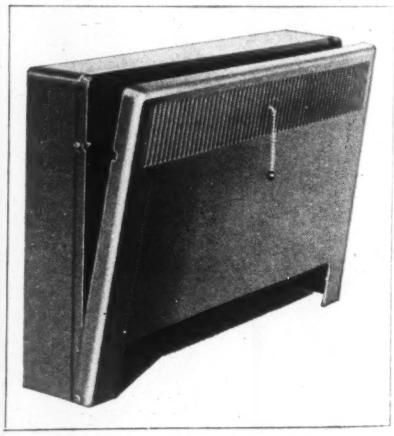
Instead of using a centrifugal pump to circulate the refrigerant, it is also possible to use a jet type liquid circulation accelerator. This unit operates by the pressure of the refrigerant which is re-admitted to the evaporator through the float.

This refrigerant is passed through a jet or a restricted orifice, pulling with it a quantity of the refrigerant in the evaporator, which is then delivered to the spray nozzles inside the evaporator. With this type of arrangement, it is necessary to have a receiver in which to store a portion of the refrigerant to be used for starting the flow of the refrigerant. By spraying the refrigerant against the side walls of the evaporator, the little gas bubbles which are formed on the walls of the evaporator by the evaporation of the refrigerant, are washed off, thereby materially increasing the heat transfer factor. These little gas bubbles on the walls of any type of evaporator form a definite insulation, thereby tending to cut down the rate of heat transfer.

The advantages of this type of unit are that it is low in first cost, simple in operation, and can produce a ton of ice at low operating cost.—Carl F. Boester, 101 E. Essex, Kirkwood, St. Louis, Mo.

Concealed Copper Radiation

No. 1612—Two new lines of enclosures for copper radiation which have been simplified in design and incorporate such features as manually removable fronts have been announced. These lines are known as the "Standard" and the "Institutional" copper convectors, the first for use in apartments, stores, offices, hotels and dwellings, and the second designed specifically for hospitals, sanitariums and other institutions.



The institutional line includes "specials" which were previously treated as extras, among which are lock type removable fronts, lock type dampers, heavier gages of metals, and square lattice grilles. The lock type front and damper require the use of a key.

The heating unit is of copper and copper alloy construction and may be used on any type of steam system and on forced flow or gravity hot water systems.—Modine Mfg. Co., 17th St., Racine, Wis.

Electric Temperature Control

No. 1613—The new self-contained electric temperature regulator illustrated combines simplicity and compactness and is suit-

17 STORIES OF COMFORT

Supplied by Sturtevant Air Conditioning Equipment

New Southern New England Telephone Building
New Haven, Connecticut

Purpose of Building:—Used entirely for the business offices of the Telephone Company.

Purpose of the Installation:—Complete air conditioning of the basement, first floor, mezzanine and second floor—ventilation and humidification for balance of building.

Sturtevant Equipment Furnished:—12 Silentvane Fans, 45 Air Blender Units, 3 Dehumidifiers, and 3 Rexvane Unit Heaters.

Capacity of Equipment:—198 Tons of air per hour.

Associate Architects:—R. W. Foote and Douglas Orr, New Haven.

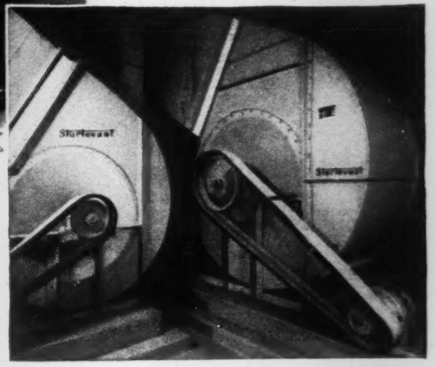
Consulting Engineers:—Hubbard, Rickerd and Blakely, New Haven.

General Contractor:—Dwight Building Company, New Haven.

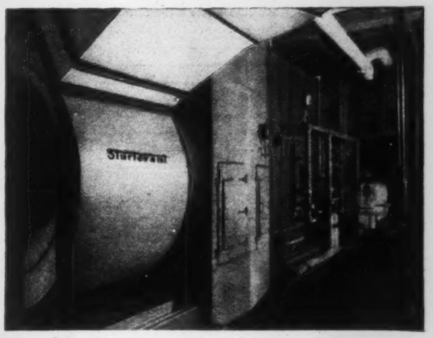
Heating, Ventilating & Air Conditioning Contractors:—Libby & Blinn, Hartford.

B. F. STURTEVANT COMPANY
HYDE PARK, BOSTON, MASS., *Branches in 40 Cities*
B. F. Sturtevant Company of Canada, Ltd.
Galt, Toronto, Montreal

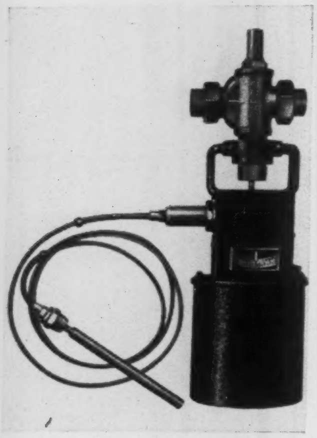
Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work



Photos show two of the Sturtevant Silentvane Fans and one of the Sturtevant Air Washers installed in Southern New England Telephone Building, New Haven.



Fans, Blowers, Air Washers, Air Conditioning, Heating, Vacuum Cleaning, Drying, Mechanical Draft Equipment



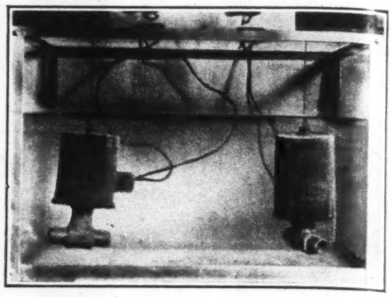
able for any temperature between minus 40 F and plus 650 F. Each regulator can be calibrated at the factory for any desired temperature and is then adjustable in the field 50 deg higher and lower than factory calibration. Operation is by single phase a-c current, 110 or 220 volts, 60 cycles, and no relays are required. Current consumption is less than 50 watts.

The valve is of the throttling type and will adjust itself automatically to any position between wide open and closed, required for close control, states the manufacturer. The sensitivity of the regulator is adjustable in use to assure balanced control without hunting. —Sarco Co., 183 Madison Ave., New York, N. Y.

Magnetic Stop Valves

No. 1614—Details of performance tests conducted in the development of a new line of magnetic stop valves were recently released by the maker. Each has been subjected to more than 25 breakdown and performance tests, and the new valves will operate satisfactorily under water, at reduced voltage, at higher maximum pressure differentials, and under very severe on and off service, it is stated.

Breakdown tests indicated that the valve will operate at least 850,000 times without failure of parts, which was calculated to equal a life of eight years at 12 operations per hour, 365 days a year. In the average installation, this equals a valve life of 10 years. Tests on the coil showed that it will stand up indefinitely with the current on continuously and with the valve plunger block closed so that the magnetic circuit is incomplete. Further heat tests showed the ability of the valves to hold up under widely fluctuating voltage conditions.



The magnetic coil and the "Flamenol" leads in each valve are waterproof to eliminate failures due to condensation of moisture when valves are installed in low temperature or high humidity rooms.

These magnetic valves are available for liquid and suction line refrigerant control for "Freon," methyl chloride and ammonia, and for brine, steam, water, air and gas. Capacities range from 2 to 75 tons.—Alco Valve Co., 2628 Big Bend Blvd., St. Louis, Mo.

Unit Heaters

No. 1615—Illustrated is the improved "Kramer" unit heater whose various features are summarized as follows:

The condensing coil is simple in construction, consisting of a series of horizontally placed hairpin tube bends, oval in cross section, with one end of one leg brazed into a cylindrical steam supply manifold and the other end into a return manifold. The fins are fused metallically to the tubes and the entire heating element is of copper. The hairpin bend is designed to provide positive compensation for thermal expansion and contraction and each tube is free to expand independently of the others. The oval tube is used because of low resistance to air flow, giving

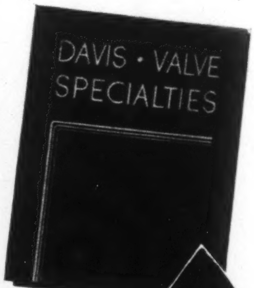
A good line for you to know!

PRODUCTS MADE BY DAVIS REGULATOR CO. (Standard Items)	Built to following pressure standards: 125 lbs.	250 lbs.	400 lbs.	600 lbs.	1500 lbs.	Materials: Body: Bronze	Semi-steel	Cast Steel	Trim: Bronze	Nickel Iron	Monel	Stainless Steel	Range of standard sizes:	Service: Steam	Air	Gas	Water	Oil
CONTROLLERS, Liquid Level	X	X	X				X	X	X			X	6", 8", 10" Floats				X	X
GOVERNORS, Pump	X	X	X			X	X	X	X		X	X	½" to 4"	X				
REGULATORS, Boiler Fuel Line	X	X	X			X	X	X	X	X	X	X	½" to 6"			X		X
Damper	X	X					X		X				3" or 4" x 12"	X				
Flow	X						X		X				10" to 24"	X				
Pressure	X	X	X	X	X	X	X	X	X	X	X	X	½" to 14"	X	X	X	X	X
STRAINERS, Pressure Line	X	X	X	X	X	X	X	X	X	X	X	X	⅜" to 12"	X	X	X	X	X
Suction Line	X						X		X			X	⅜" to 14"				X	X
TRAPS, Air	X	X					X		X				¾"		X			
Condensate	X	X	X				X	X	X		X	X	2" to 6"	X				
Steam	X						X		X			X	½" to 3"	X				
VALVES, Altitude	X	X	X				X	X	X		X	X	2" to 14"				X	
Back Pressure	X						X		X				2" to 24"	X		X		
Balanced	X	X	X	X		X	X	X	X	X	X	X	½" to 24"	X			X	X
Butterfly	X					X	X	X	X			X	3" to 24"	X			X	X
Check, Balanced	X	X	X	X			X	X	X			X	6" to 24"	X		X		
Check, Cushioned	X	X	X				X	X	X			X	2" to 12"	X			X	X
Diaphragm Motor	X	X	X	X		X	X	X	X	X	X	X	½" to 14"	X	X	X	X	X
Exhaust Relief	X						X		X				6" to 48"	X				
Float	X					X	X		X	X			½" to 12"				X	
Fluid Control	X	X				X	X		X	X			½" to 12"				X	X
Lever Operated	X	X	X	X		X	X	X	X			X	¾" to 24"	X	X	X	X	X
Low Water Fuel Cut Out	X	X	X				X	X	X			X	¾" to 4"					X
Motor Operated	X	X				X	X		X				½" to 10"	X	X	X	X	X
Pilot	X	X	X			X	X	X	X		X	X	⅛" to 2"	X	X	X	X	X
Relief	X	X	X				X	X	X			X	⅜" to 16"	X	X	X		
Relief, Balanced	X	X				X	X		X		X	X	½" to 14"	X		X		
Relief, Comb. Pres. & Vac.	X						X			X			2" to 8"			X		
Solenoid Operated	X	X	X	X	X	X	X	X	X	X	X	X	½" to 12"	X	X	X	X	X
Stop and Check	X	X	X	X	X		X	X	X			X	2" to 14"	X			X	
Trip, Emergency	X	X	X				X	X	X	X		X	½" to 14"	X		X		X
Turbine Non-return	X	X	X				X	X	X			X	4" to 24"	X				
Vacuum Breaker	X						X	X	X				2" to 12"		X	X	X	X

TAKE a minute and check through the Davis line. If it reminds you that there are some places where you want to put in a better regulator . . . a better float box . . . or a better control valve, then the time is well spent.

You will also be spending time well if you will take another minute or two and drop Davis a line asking that you be sent interesting descriptive literature setting forth the features . . . the advantages . . . the proper method for making selections . . . and the proper application of individual items in the Davis line. Be sure to mention the products you are interested in. Or, if you prefer, just ask for the Davis general catalog.

DAVIS REGULATOR COMPANY,
2546 S. Washtenaw Ave.
Chicago, Ill.



Established in 1875

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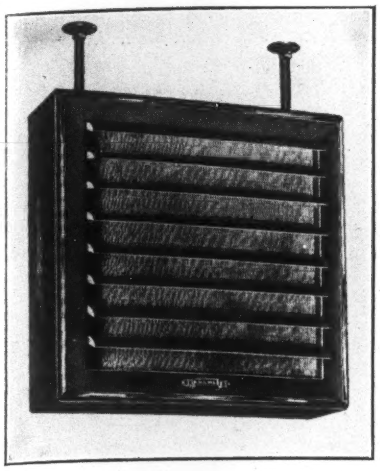
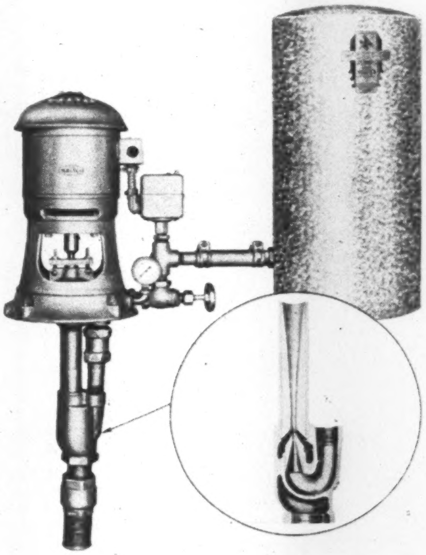


high discharge air velocities at minimum power cost with moderate final air temperatures, according to the maker.

These units may be used with any steam pressure up to 150 lb. The frame is finished in twilight gray crackle enamel baked on, with stainless steel trim on the front and sides. Stainless steel louvers may be had at extra cost. With the exception of the smallest two units, all models operate at no higher than 1140 rpm. Fans are of the four blade type.—Trenton Auto Radiator Wks., 626 Brunswick Ave., Trenton, N. J.

Jet Pump

No. 1616—Incorporating several improvements, a new jet pump provides a selection of 1/3 to 1 hp units, with wide-range gallonage capacities for industrial plant and other applications.

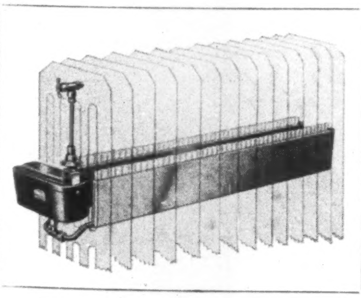


One of the features is simplicity of construction, which places the impeller (the pump's only moving part) above the ground where it can be easily and quickly inspected. The impeller is precision machined from a single bronze casting, and is driven by a vertically mounted, capacitor motor. This direct motor-to-pump hook-up minimizes operating noise and provides a steady, non-pulsating stream of water, states the maker.

There are no sucker rods or drive shafts used. Constructional advantages include scientifically shaped jet assembly, which insures extra gallons per horsepower; oversize stuffing box; and heavy duty brass screened strainer.—Westco Pump Div., Micro-Westco, Inc., Bettendorf Bldg., Bettendorf, Iowa.

Automatic Humidifier for Radiators

No. 1617—The "Ol' Faithful" automatic humidifier is available in two sizes for use in buildings heated by hot water, vapor or vacuum steam heating systems. It consists of two copper evaporators concealed inside the loops of the radiator sections, and a float controlled water feeder which is housed in a black enameled reservoir



Remote Control

- INEXPENSIVE
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- SIMPLE
- AS EASY AS TUNING A RADIO
- IDEAL FOR HOTELS, OFFICE AND ALL PUBLIC BUILDINGS

The Tuttle & Bailey Remote Control No. 960 solves one of the toughest problems of the air conditioning of large buildings where it is necessary or desirable to cater to individual preference as to **air** volume. It is a typical Tuttle & Bailey development.

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T & B

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BOSTON NEW YORK PHILADELPHIA CHICAGO

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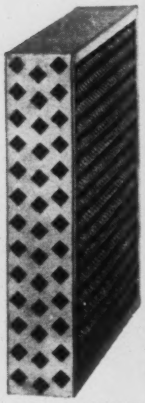
BATH
JUST LIKE
NEW
AGAIN
—after
every
cleaning!

AIR-MAZE permanent type air filter panels may be completely cleaned time and again during their long life;—and after each servicing they again have the performance and characteristics of new filters.

What economy! No replacement panels are needed as AIR-MAZE Filters should outlive the air conditioning systems in which they are used. Cleaning and "charging" are simple, economical operations, easily performed by anyone;—no special equipment or materials are required.

But economy, efficiency and trouble-free performance are only a few of the advantages of AIR-MAZE. The scientifically constructed all metal element is so designed that clogging cannot occur. The round wire baffles have no serrated edges to which lint or similar foreign matter can so cling as to prevent ready removal when cleaning.



AIR-MAZE panels can be supplied in any reasonable size and shape. Specify AIR-MAZE; you'll be pleased with results.

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- No Replacements Required.
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AIR-MAZE CORPORATION
5200 Harvard Ave. Cleveland, Ohio

AIR-MAZE
CLEANABLE AIR FILTER PANELS

(2¼x2¼x6 in.) to maintain a constant water line. Within each evaporator is a patented accordion pleated water pad which extends 3 in. above the water line to insure maximum evaporation.

When it is installed on hot water radiators, the water supply is taken direct from the radiator and it automatically vents the radiator of air. On vapor or vacuum steam installations, the water supply is run from the nearest water line in ⅛ or 3/16 in. O.D. flexible copper tubing, which may be concealed back of baseboards.—Maid-O'-Mist, Inc., 180 N. Wacker Dr., Chicago, Ill.

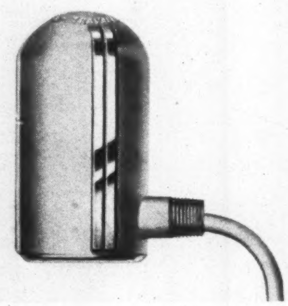
Filter Watchman

FILTER WATCHMAN
SIMPLEX CONTROLS
ST. LOUIS, MO.
PAT. PEND.

No. 1618—The purpose of this new device is to warn the owner of an air conditioning system when filters are clogged to the extent that they should be cleaned, or replaced. It is primarily a bellows operated electric switch, which is mounted on the outside of the conditioner at any point between the filters and blower.

The device may be set for any desired pressure drop through the filters. Any excess pressure depresses the bellows of the instrument making electric contact to light a red signal. The signal continues to burn until filters are removed.—Simplex Controls, 3129 So. Broadway, St. Louis, Mo.

Automatic Air Valve



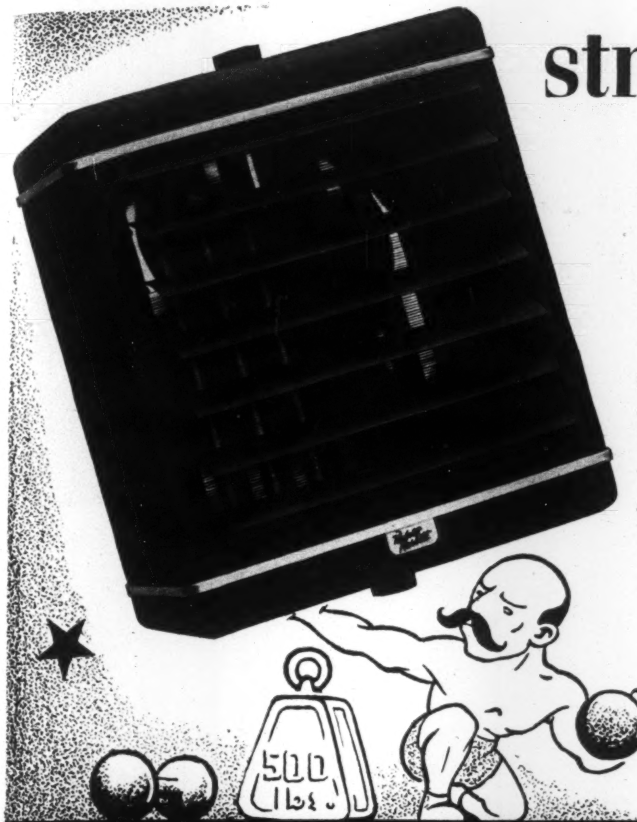
No. 1619—Illustrated is the newly designed "Travall" automatic air valve which is non-adjustable but incorporates the same design features as in the manufacturer's adjustable air valve.

It is of double shell construction, the air being vented into the annular compartment formed by the double wall and leaving through a number of small ports in the outer shell. By substituting a number of small ports for a single port, hissing is eliminated, states the maker. The syphon pipe is designed to fit the narrowest radiator.—Jas. P. Marsh Corp., 2073 Southport Ave., Chicago, Ill.

Strainers for Boulder Dam

No. 1620—The big basket type water strainers shown in the accompanying picture feature a new type of detachable cover that has been developed recently to meet the special requirements of engineers supervising construction on the Boulder Dam project. All of the cover bolts are of the "eye bolt" type. They fit in slotted openings in the cover and body flanges. Merely by loosening the nuts a few times, it is possible to swing all the bolts away from the cover so it can be removed and replaced in minimum time. This was considered necessary because of the need for virtually continuous service.

The bolts are retained by individual pins passing through the



strong on quality . . .

Endurance of the Webster-Nesbitt Unit, like the strong man's, comes from years of training, plus inherent *quality*. Trained engineers and craftsmen build Webster-Nesbitt Units, using the highest quality materials. The copper tube-and-fin heating elements are guaranteed for working steam pressures up to 150 pounds per square inch. The fans have exceptionally wide, overlapping blades of gradual pitch. The motors are rubber-isolated, quiet operating. The heavy furniture steel casings are die-formed and sturdily welded. And since Webster-Nesbitt Units operate according to the large-air-turnover, low-temperature-rise principle, their *low cost*, is another strong point in their favor. Consult the nearest Webster representative.

CATALOG ON REQUEST

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UNIT HEATERS

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Rolled and finished in one of the finest equipped rolling mills in the United States from Pure Lake Copper, Hussey is the ideal copper specification for all air conditioning installations where corrosion-resistance, permanence and ease of fabrication are important factors. It will pay you to investigate the convenience and advantages of dealing direct with your Hussey Warehouse or District office.

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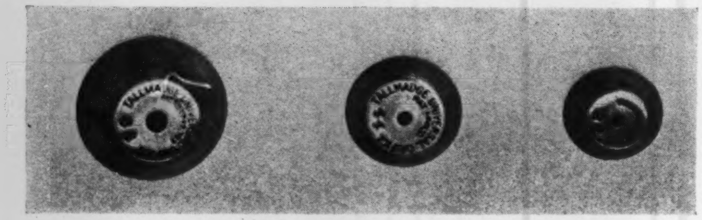
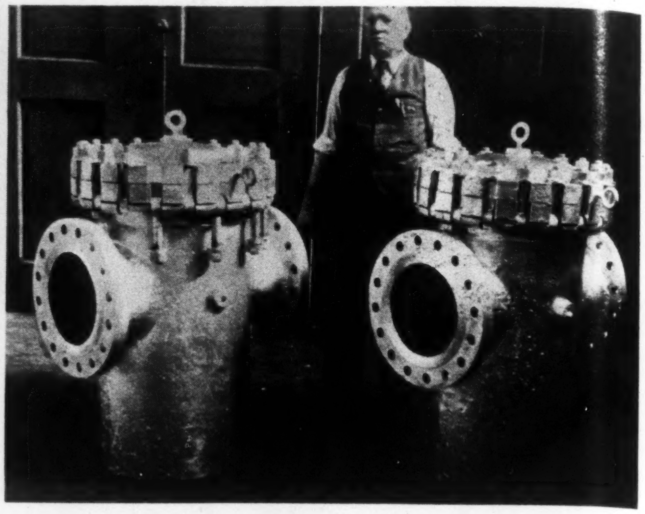
TALLMADGE
Zoned Controlled
HEATING



The resistance offered by the ORIFICE in each radiator inlet valve allows the steam to immediately flow the entire length of the mains, thus reaching every radiator which is another advantage of the Tallmadge Zoned Heating System.

BETTER HEATING AT LESS COST
GIVES GREATER COMFORT
Improves Air Conditioning

WEBSTER TALLMADGE & CO.
NEW YORK CITY

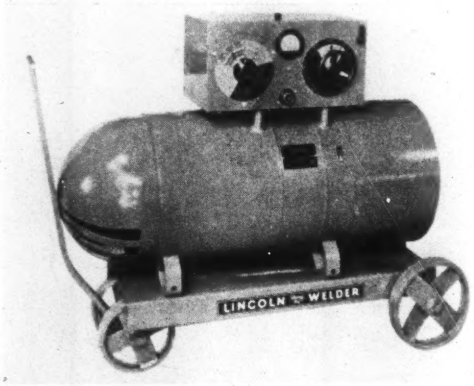


eyes. The pins in turn are retained by a two piece recessed ring which fits under the body flange.

Each strainer is built to 300 lb pressure standard for 12 in. pipe connections. The internal basket is stainless steel with 3/16 in. perforations. A rubber gasket is used under the cover.—Davis Regulator Co., 2546 S. Washtenaw Ave., Chicago, Ill.

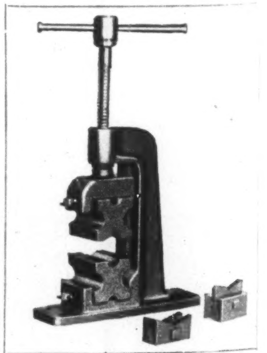
Arc Welders with Self-Indicating Control

No. 1621—New "Shield-Arc" welders are said to provide greater convenience and accuracy because of a new self-indicating dual continuous control. These welders have both job selector and current control calibrated and equipped with dials which indicate the type of work and the number of amperes for each and every setting. It is claimed that this development enables the welding operator to secure high quality welds and high welding speeds because he can vary both the slope of the volt-ampere curve and the amount of welding current independently and positively to suit every job encountered. Both voltage control (job selector) and current control are continuous in operation to provide "literally thousands" of possible combinations of voltage and current.—Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.



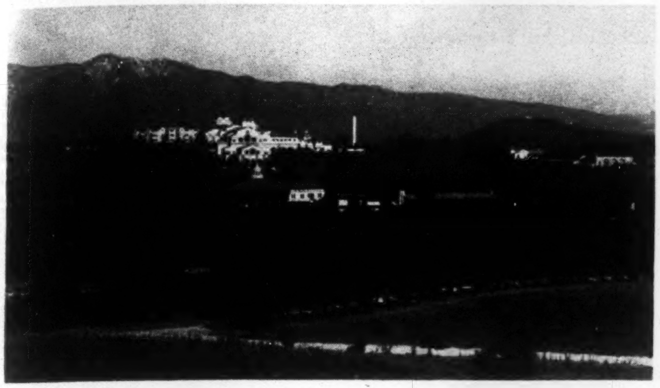
Tube and Pipe Vises

No. 1622—The "Simplex" tube and pipe vises have been designed for the more easy handling of brass and copper tubing and polished pipe as well as regular iron pipe, without scratching, marring or flattening it. The jaws are recessed for holding ⅜, ½, ¾ and 1 in. diameter tubing and are lined with a soft alloy to provide a firm grip.



REX B. CLARK'S

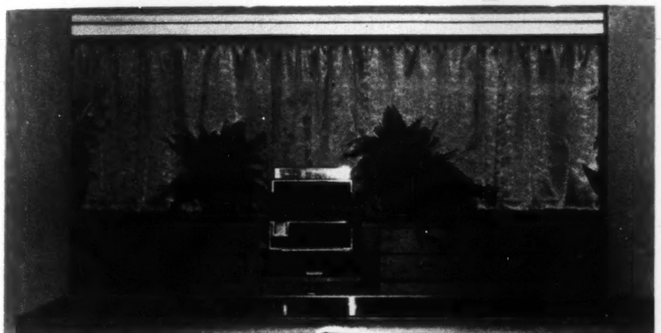
LAKE NORCONIAN HOTEL

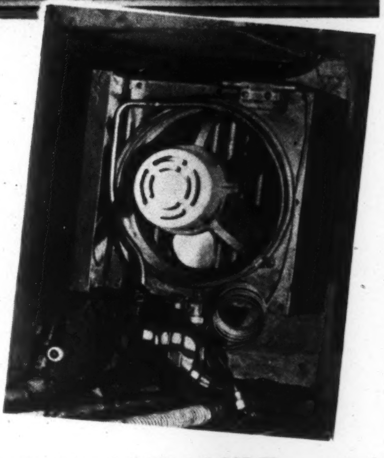


The "Charm Center of the West"

Rex B. Clark's Lake Norconian Hotel, nestled amid the beauty and grandeur of the Rockies, has a wealth of advantages, both natural and man-made, that give it rightful claim to "The Charm Center of the West." Among many clever innovations that please and interest guests is the famous "Mystery Bar."

. . . the MYSTERY BAR . . .





Instead of the usual array of bottles and glasses on the back-bar, these are all arranged in convenient drawers which are kept at a constant low temperature. Here, for the first time, Refrigeration is used to keep glasses as well as liquor cold.

- Refrigeration used is controlled by A-P Model 205 Thermostatic Expansion Valves.

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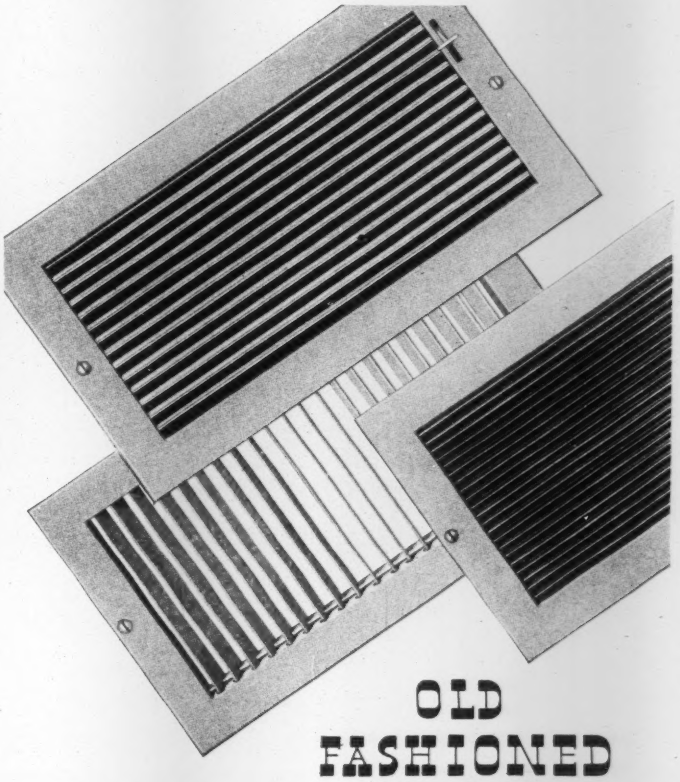
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN

Refrigeration Parts Jobbers, Who Recognize Quality, Stock A-P Valves

DEPENDABLE
THE BYWORD FOR A-P CONTROLS



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Go into any building equipped with AUER Registers and Grilles. Notice how well these smooth, modern faces fit into the general picture. Beneath that surface beauty, all AUER products have everything a good register must have. Auer offers an appropriate, *dependable* model for every heating and air conditioning purpose.

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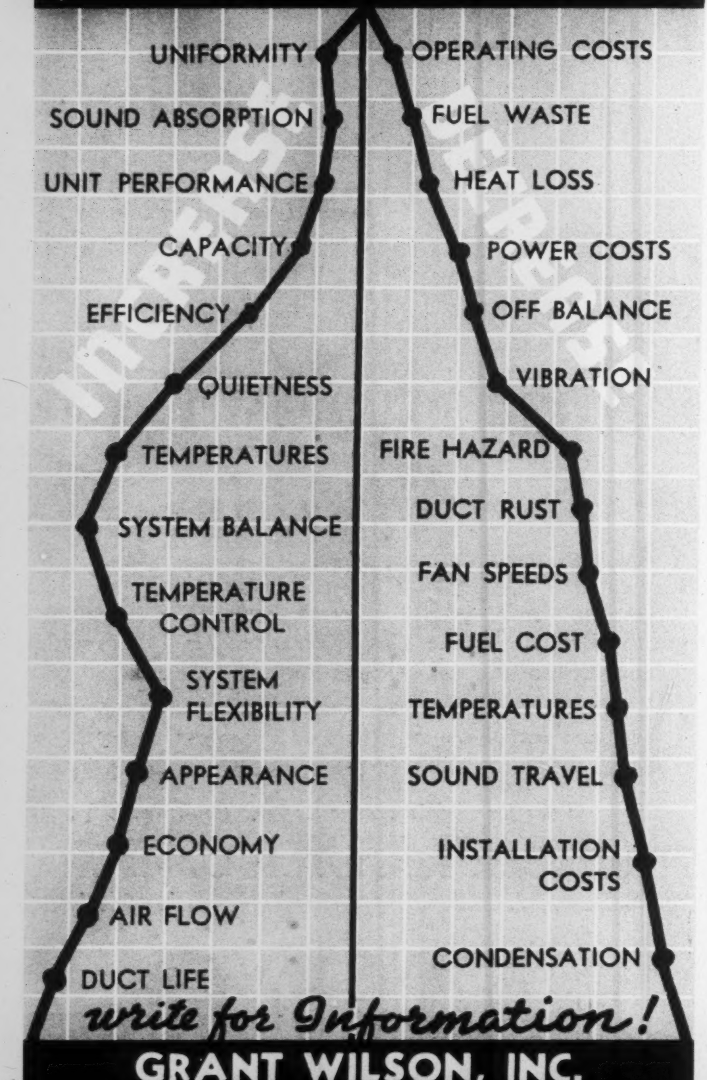
& GRILLES

For Air Conditioning *and* Gravity

INSULATE EVERY
DUCT
with Asbestos Protected
DUX-SULATION
. . . FOR A BALANCED AND
CONTROLLED OPERATION OF
AIR CONDITIONING SYSTEMS



write for Information!

GRANT WILSON, INC.
4101 West Taylor Street Chicago, Illinois

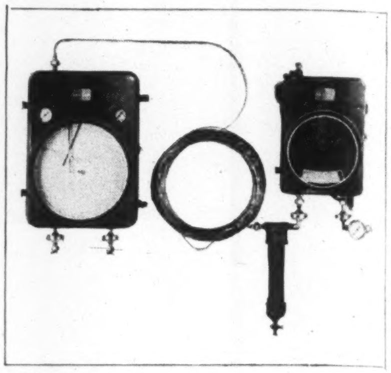
PLANT RUBBER & ASBESTOS WORKS
537 Brannan Street San Francisco, Cal.

AIR CONDITIONING UTILITIES CO.
8 West 40th Street New York, N. Y.

The set of corrugated pipe jaws has a capacity of 1½ in. diameter pipe when the non-marring feature is not required.—Desmond-Stephan Mfg. Co., Urbana, Ohio.

System of Pneumatic Telemetering

No. 1623—The "Metavane" system of pneumatic telemetering is offered for the distant measurement of temperature, flow, pressure and liquid level and may be used for recording, indicating and controlling. Air under pressure is used throughout for power and the system is therefore particularly suited for use in plants where explosive fumes are present, says the maker.



The system consists of two instruments, the transmitter and the receiver, connected by means of copper tubing. A 15 lb air supply is introduced at the transmitter to provide power and the transmitter and receiver may be several hundred feet apart.

The transmitter is essentially a free-vane pressure controller with narrow throttling range and the control point of this instrument is varied by its measuring element to maintain an air pressure at the receiver corresponding or equivalent to the value of the quantity under measurement. The recording receivers are standard recording pressure gages, actuated by air under pressure and the controlling receivers are automatic controllers which are available in two different types.—Bristol Co., Platts Bridge, Waterbury, Conn.

Insulating Refractories

No. 1624—The "M-S 20" brick illustrated is a machine mixed, hand molded shape developed for insulating refractory use in the 2000 F temperature zone. Expanded "Zonolite," introduced into a balanced blend of selected clays and alkaline fillers, assures practically neutral reactions, states the maker, and the brick is not dependent for its porosity on burnt-out organic matter.

Features as listed by the maker are that it is non-spalling, oxidation resistant, has mechanically supported porosity, low heat capacity, and that it can be shaped with woodworker's tools. Its density is 26.6 lb per cu ft.—Munn and Steele, Inc., 500 Fifth Ave., New York, N. Y.

Book Reviews

Engineers' Manual

["The Engineers' Manual," by Ralph G. Hudson, professor of electrical engineering and in charge of courses in general science and general engineering, Massachusetts Institute of Technology. 2nd ed. 1939. 340 + iv pp., 5x7¾ in., flexible binding. Published

FULTON
Sylphon
TRADE MARK
FOR
TEMPERATURE
CONTROL

• of Building Zones

Sylphon Electric Valves open an entirely new field of possibility to the architect and heating engineer. With an amazing adaptability to space heat control problems ranging from a single radiator to an entire building—they offer remote-thermostat-controlled, heat-motor-operated valve service at a fraction of the usual cost.

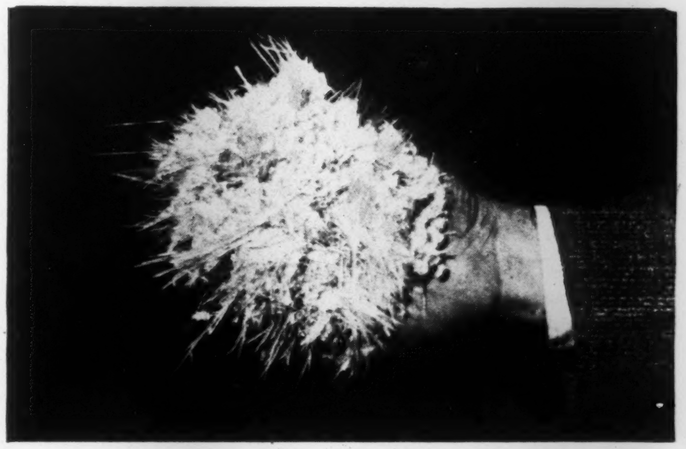
They permit all the multifarious wiring arrangements which include such elements as manually operated remote station switches, electric time switches, indoor-outdoor dual thermostat control, etc. Yet there are no levers, no wearing parts. Nothing to lubricate. No mechanism to adjust. And the system is noiseless.

The unique "heat motor" in the Sylphon Electric Valve is the secret of this valve's operation. Developed by Fulton Sylphon engineers—this "motor" is not literally a motor at all, but is a tiny metal bulb containing a volatile liquid. When warmed by a low voltage current passing through the resistance coil surrounding it, this liquid expands, producing pressure inside a Sylphon Bellows to operate the valve.

Look into this and other modern Sylphon Controls described in the following Bulletins. Ask for your copies.

● Individual Room Temperature Control—Bulletins CE 80 and CE 70 . . . Zone Control—Bulletin CE 70 . . . Space Heat Control in Large Industrial Areas—Bulletins CE 50 and CE 70 . . . Duct Type Heating and Air Conditioning Controls—Bulletin CE 50 . . . Service Hot Water Supply Control—Bulletins CE 20 and CE 40 . . . Drinking Water Temperature Control—Bulletin CE 20.

THE FULTON SYLPHON CO.
KNOXVILLE, TENNESSEE
Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England



A Word About DRY-PAC for *your* Protection

The key to efficiency in an underground steam conduit system is largely found in the type of *insulation* used. Dry-paC is *not* a general term for any ordinary or even a loose asbestos filler—but an exclusive registered trade mark applied only to a Ric-wiL product manufactured entirely in our own factory and fully guaranteed by us.

Dry-paC is NOT cheap commercial asbestos—it is a proven combination, 85% high grade long-fibre asbestos combined with 15% carefully selected, clean sponge particles, all processed to make the mass positively water repellent. It is manufactured under strict laboratory control at all times and guaranteed to meet definite specifications which we will gladly furnish on request. Secure and use these specifications on your next installation.

Accept no substitute for Dry-paC—there really *is* none.

REMEMBER—a Ric-wiL system, with genuine Dry-paC Insulation, keeps your steam lines permanently tight, dry, and at least 90% efficient. Descriptive bulletin and test data sent promptly on request.

The Ric-wiL Co., Union Trust Bldg., Cleveland, Ohio
New York Chicago
Agents in principal cities

Dry-paC is not made to meet a price—specify it fully as described above and obtain our "Certificate of Warranty" furnished with every order.

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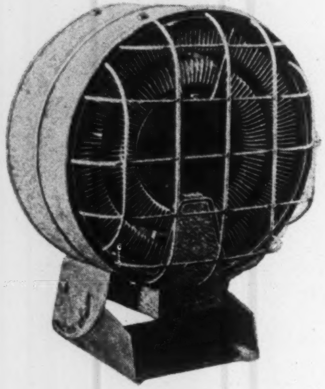
RIC-WIL
CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

Heating system inadequate?
—add ELECTRIC HEAT

Perhaps it happens only on the coldest days—but why tolerate discomfort in shop or office, with attendant sickness and production loss, when a few Chromalox electric air heaters will bring relief? Consider the saving, too, in overtime heating, when the Chromalox heaters often enable the boiler plant to shut down with the whistle while the busy plant section or office works on . . . and the further saving in early spring, when you can shut down the unwieldy boiler plant weeks ahead of the usual time, letting your Chromalox air heaters handle the occasional chilly days.

Many shops and offices have found true economy in this form of heating comfort. Easily installed, anywhere. Types for all needs, in all capacities to 20-Kw.



64 pages of valuable data, at your request.

The heating element in Chromalox electric air heaters is the familiar Chromalox unit, used everywhere for a wide variety of industrial electric heating applications. Its efficiency and unsurpassed service life have been proved in thousands of industrial plants. It is the product of years of specialized experience in electric heat development—an experience which is at your service in all questions of electric heat, whether they involve the heating of air, gases, processes, liquids, machine parts, etc. Write for the 64-page Chromalox catalog and handbook, and bring your heating problems to us.

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Supplies the insulation that has what it takes for
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REPELS MOISTURE
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THE PACIFIC LUMBER COMPANY
SAN FRANCISCO CHICAGO LOS ANGELES NEW YORK

by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price, $2.75.]

This work originated from the conception that the practicing engineer or engineering student would welcome a consolidation of the formulas and constants for which he might otherwise search through several volumes, and that the application of each formula might be explained more concisely than in texts devoted exclusively to the process of derivation. With this end in view, the engineering formulas, mathematical operations and tables of constants which seem to be most useful are presented in systematic order in a book designed to fit the pocket.

Sections are included on mathematics, mechanics, hydraulics, heat, electricity, mathematical tables, steam tables, conversion factors and other tabular data.

Design of Industrial Exhaust Systems

["Design of Industrial Exhaust Systems for Dust and Fume Removal," by John L. Alden. 1st ed. 1939. 220 pp., 5½x8½ in., clothbound. Published by the Industrial Press, 148 Lafayette St., New York, N. Y. Price, $3.00.]

The purpose of this book is to tell the engineer how to design and build or how to buy an exhaust system that will adequately and economically perform the functions prescribed by the industrial hygiene expert, or by law. Among the subjects covered are exhaust ventilation, low pressure pneumatic conveying, design of hoods, piping and structural details, and selection of dust separators and centrifugal exhaust fans.

The chapters are entitled flow of fluids, hood forms, air flow through hoods, pipe resistance, piping design, dust separators, low pressure conveyors, centrifugal exhaust fans, structural details and system planning, and field measurements and their interpretation.

Estimating

["How to Estimate for the Building Trades," by Gilbert Townsend, Ross & Macdonald, architects; J. Ralph Dalzell, head, architectural engineering department, American School; James McKinney, educational director, American School, with electrical sections by Carl H. Dunlap, head, electrical engineering department, American School. 629 pp., 5½x8¼ in., clothbound. Published by American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price, $4.75.]

This new book is intended to be a practical and complete presentation on the estimating of materials and labor for residences and moderate size buildings. It has been prepared in "how to do it" style. It includes some 300 illustrations, 44 tables, 555 questions and answers, and is thoroughly indexed. There are eight full size blueprint sheets of a house complete in all details and drawn to standard scale, which come in a pocket attached to the inside back cover.

The topics discussed include carpentry, lath and plaster, air conditioning, sheet metal, linoleum, painting, masonry, marble and tile, electrical wiring, plumbing, glass and hardware.

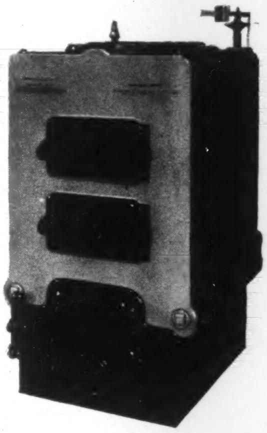
Schools and Study Courses

New York City Building Code

The School of Architecture and Allied Arts, New York University, 1071 Sixth Ave., New York, N. Y., recently announced a course of 15 lectures on the new building code and other laws applicable to building in the city of New York. The course—the first meeting of which was scheduled for February 1—is designed for architects, engineers, builders and others concerned with building enterprises and is given by Samuel L. Becker, professional engineer and lawyer, and formerly chairman of the building code committee of the board of buildings.

Hank Sez:-

As How 42 Families Have Ample Hot Water For $468



This is the Burnham High Pressure Boiler that did the trick.

Whenever a feller gets to blowing kinder stiff about how he burns next to no coal at all in his boiler, and as how the house is so durn hot, in even zero weather, that they have to hist the winders, I sorter think of our old friend Ananias.

So maybe you lifted your eye brows at that title about 42 families having plenty of hot water for $468.

Sit down won't yer and let's gas a bit about it, fur it's the truth.

At 1825 Riverside Drive down in li'l ole New York, there's a 42 family apartment house what uster burn 115 tons of coal each year costing around $1121. fur making hot water.

A while back they got all fed up, and yanked out the boiler and put in a Burnham. Superintendent Fred Kaiser swears on a stack o' Bibles, that now they burn only 66 tons o' buckwheat, costing, $468, as against $1121.

A saving of $653, which ain't so turrible bad.

Course he may be using a lower grade fuel. But even so, it's a Burnham that's burning it, with natural draft at that.

If you want ter check up. The owners are the Mutual Life Insurance Company. The agent is Wood Dolson.

Hank Hindle

Burnham Boiler Corporation
Manufacturers of Heating Equipment Since 1873
IRVINGTON, NEW YORK ZANESVILLE, OHIO
Export Department:
50 Church Street, N. Y. City

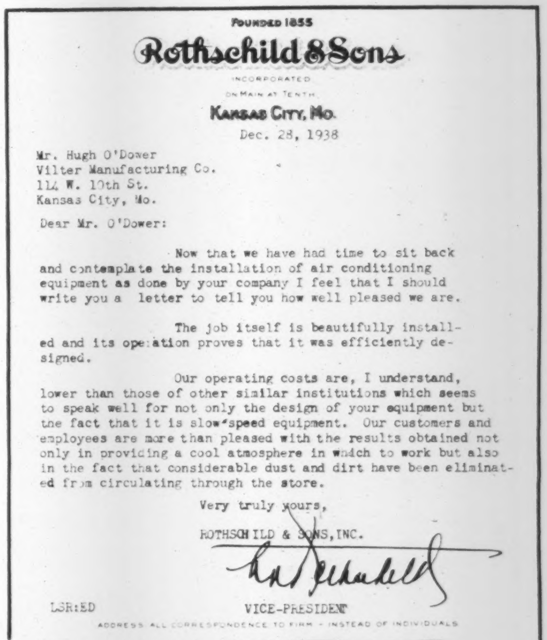
Burnham Boiler

Our VILTER Air Conditioning

"Efficiently designed . . . .
. . beautifully installed . .
operating costs . . lower . "
L. S. Rothschild

The high operating efficiency and low maintenance costs . . . the general satisfaction of Vilter Installations . . . is graphic evidence of the rich experience of Vilter personnel, gained through many years of pioneering in modern Air Conditioning.

The many problems involved in providing for human comfort—or food protection—all can be solved most profitably, most satisfactorily, with Vilter Equipment. Check into a Vilter Installation in your vicinity for proof of this fact, then let us help you to greater efficiency on your next job of Air Conditioning or Refrigeration.



FOUNDED 1855
Rothschild & Sons
INCORPORATED
ON MAIN AT TENTH
KANSAS CITY, MO.

Dec. 28, 1938

Mr. Hugh O'Dower
Vilter Manufacturing Co.
114 W. 10th St.
Kansas City, Mo.

Dear Mr. O'Dower:

Now that we have had time to sit back and contemplate the installation of air conditioning equipment as done by your company I feel that I should write you a letter to tell you how well pleased we are.

The job itself is beautifully installed and its operation proves that it was efficiently designed.

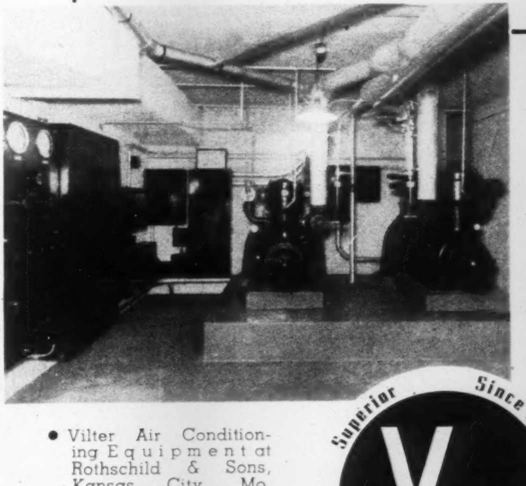
Our operating costs are, I understand, lower than those of other similar institutions which seems to speak well for not only the design of your equipment but the fact that it is slow-speed equipment. Our customers and employees are more than pleased with the results obtained not only in providing a cool atmosphere in which to work but also in the fact that considerable dust and dirt have been eliminated from circulating through the store.

Very truly yours,

ROTHSCHILD & SONS, INC.

LSR:ED VICE-PRESIDENT

ADDRESS ALL CORRESPONDENCE TO FIRM - INSTEAD OF INDIVIDUALS



- Vilter Air Conditioning Equipment at Rothschild & Sons, Kansas City, Mo. Store. W. L. Cassell, Consulting Engr.

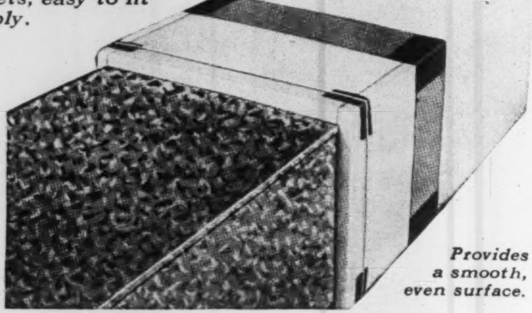
THE VILTER MFG. COMPANY
2148 S. First St.
Milwaukee, Wis.

Superior Since 1867
VILTER
Air Conditioning
Refrigeration . . .

FOR MODERN HEATING AND AIR CONDITIONING USE . . .

Careycel ASBESTOS INSULATIONS

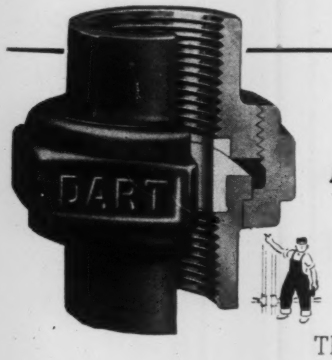
Careycel Duct Insulation is available in convenient size sheets, easy to fit and apply.



Provides a smooth, even surface.

● **CAREYCEL—the modern asbestos product developed by Carey—is the perfect material for insulating air conditioning ducts. Combines the low heat transmission characteristics of organic structures, such as cork or hair, with the fireproof qualities of asbestos. Decay-proof, insect proof, negligible shrinkage, low cost. See your Distributor or write for folder and samples.**

THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
BRANCHES IN PRINCIPAL CITIES



No Replacement Needed

IT'S A DART UNION

The useful life of a Dart Union is far from over when it's taken off the line. For Darts have two bronze seats ground to a true ball joint that assures contact all around, over their full width. They make up to tight joints **under repeated use,** give leakproof service long after ordinary unions have been discarded. Moreover, heavy malleable iron bodies and nuts rule out stretch and thread distortion. Send for a Dart to try, without obligation.

DART
UNIONS
E. M. DART MFG. CO., PROVIDENCE, R. I.

SALES AGENTS: THE FAIRBANKS COMPANY, NEW YORK, AND ALL BRANCHES
CANADIAN FACTORY: DART UNION COMPANY LTD. TORONTO CANADA

Among the topics for discussion are history and development of building regulations; departmental organization, powers, and duties; relationship to other departments; procedure to obtain permits; scope and purposes; important definitions, classification and building restrictions; heating, ventilation, and air conditioning; means of egress; special occupancy structures; plumbing; elevators; fire prevention; standpipe and sprinkler systems; zoning and planning; and multiple dwelling and labor laws.

Conventions and Expositions

American Society of Mechanical Engineers and Louisiana Engineering Society: Joint meeting, February 23-25, St. Charles Hotel, New Orleans, La. Program includes The Industrial Renaissance of the South, by Eugene O'Brien; Burning Oat Hulls, by C. J. Herbeck; Burning of Pulp Mill Waste from a Sulphite Mill, by Grover Keeth; Burning Various Types of Oil Refinery Fuels, by A. L. Wilson; Combustion of Wood Waste Fuels, by Henry Kreisinger; Burning Bagasse, by E. W. Kerr; Byproduct Fuels in the Steel Industry, by Gordon Fox and W. B. Clemmitt; Design and Construction of High Pressure Equipment Used for the Completion of Deep Wells, by Herbert Allen; Lignite—A Grate Fired Fuel of the Future in the South West, by C. J. Eckhardt, Jr.; Burning Modern Bunker Fuel Oils, by J. A. Hayes; Pulverized Coal Tar Pitch as a Fuel, by E. W. Clarke; and others.

Air Conditioning Conference: March 8-9, University of Illinois, Urbana, Ill. Sponsored by Department of Mechanical Engineering and the Engineering Experiment Station. Chairman, Prof. W. H. Severns, University of Illinois, Urbana, Ill. Papers to be presented include Equipment for All-year Air Conditioning, by W. H. Severns and P. E. Mohn; Characteristics of Duct Systems and Fans, by S. H. Downs; Introduction and Diffusion of Conditioned Air in Rooms, by D. W. Nelson; Regulation of Air Temperature and Humidity, by C. L. Ringquist; Physiological Responses of the Body to Its Environment, by Dr. Charles Sheard; The Cooling Load and Refrigerating Problems in Comfort Air Conditioning, by R. E. Gould; Building Insulation Types and Applications, by S. Konzo; Condensation Problems in Modern Buildings, by L. V. Teesdale; Air Conditioning Water Supply and Disposal, by W. D. Gerber; and Conservation of Water by Using Cooling Towers and Evaporative Condensers, by S. I. Rottmayer.

American Society for Testing Materials: Regional meeting, March 8, Deshler-Wallick Hotel, Columbus, Ohio. Headquarters Office, 260 S. Broad St., Philadelphia, Pa. Program includes Symposium on Thermal Insulating Materials with papers on Factors Influencing Thermal Conductivity, by J. B. Austin; Methods of Testing Insulation, by H. H. Rinehart; One Consumer's Problems in Selecting Heat Insulation, by E. T. Cope and W. F. Kinney; and Effect of Solar Radiation on Heat Transmission Through Walls, by F. C. Houghten, Carl Gutberlet, and Albert A. Rosenberg.

International Acetylene Association: Annual convention, March 8-10, Rice Hotel, Houston, Texas. Headquarters office, 205 E. 42nd St., New York, N. Y.

Air Conditioning Conference: March 23-25, Oregon State College, Corvallis, Ore. General chairman, E. C. Willey, Oregon State College, Corvallis, Ore.

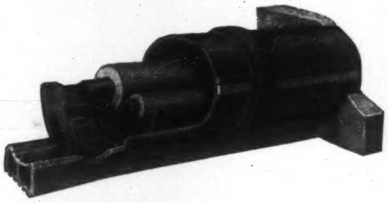
American Society of Refrigerating Engineers: Spring meeting, May 22-23, Hotel Hershey, Hershey, Pa. Headquarters office, 37 W. 39th St., New York, N. Y.

Association of Gas Appliance and Equipment Manufacturers: Annual convention, May 24-26, Roosevelt Hotel, New York, N. Y. Headquarters office, 60 E. 42nd St., New York, N. Y.

Heating, Piping and Air Conditioning Contractors National Association: 50th annual convention, May 31-June 2, Drake Hotel, Chicago, Ill. Headquarters office, 1250 Sixth Ave., New York, N. Y.

Smoke Prevention Association: Annual convention and ex-

ADSCO-BANNON CONDUIT
TILE CONDUIT FOR UNDERGROUND LINES



For Underground Steam or Other Pipe Lines

A separable, salt-glazed vitrified tile conduit available with or without a base drain for one or more pipes. Combines strength, simplicity and durability. Easily installed at low labor cost. Easily separated on the job with a cleancut fracture. Adaptable to various types of insulation and installation conditions.

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Cincinnati, O.

City-County Hospital
Fort Worth, Tex.

Northwestern University
Evanston, Ill.

Penna. State College
State College, Pa.

Pennhurst State School
Pennhurst, Pa.

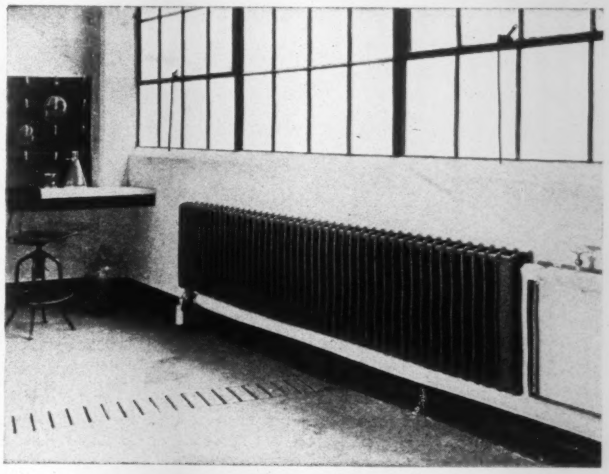
State Teachers College
Kirksville, Mo.

U. S. Army, Bolling Field
Bolling Field, D. C.

Utica Knitting Co.
Utica, N. Y.

Western State Teachers College
Bowling Green, Ky.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS



Perkins Radiator operating on high pressure steam in the Pittsburgh laboratory of the American Cyanamid & Chemical Corporation.

SHAW-PERKINS HEATING UNITS

Operate on all pressures up to 150 lb.

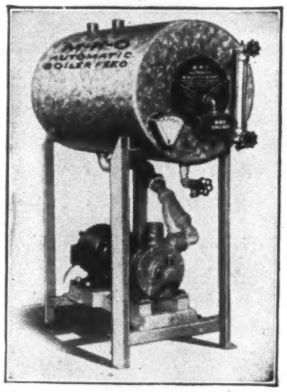
Combine the most advantageous features of convector—radiator—and unit heater. Approximate unit heater performance in air movement, while delivering a desirable proportion of radiant heat. At elevated steam pressures the surface temperatures are lower than those of the conventional exposed types operating on low-pressure steam.

Write for a copy of "Modern Radiation"

SHAW-PERKINS MANUFACTURING COMPANY
Oliver Building . . . . . . Pittsburgh, Pa.

Have you investigated the probability of saving . . . using the

M-K-O Boiler Feed?



Steam boilers must maintain a *constant water level* if they are to operate efficiently and economically. If city water pressure is too low, you can SAVE with this Boiler Feed. The M-K-O is *entirely automatic* in action, is operated electrically to pump feed water against high boiler pressure. It returns condensate to boiler. Supplies make-up water as needed. Keeps your boilers—whether gas, oil, stoker or hand fired—in tip-top operating condition. If you haven't investigated this source for saving, DO IT NOW. Descriptive Bulletins are yours for the asking—and there's no obligation at all.

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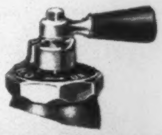

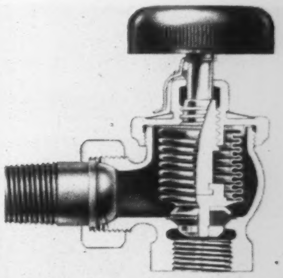

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PACKLESS
INLET VALVES

FOR PERMANENCE WITH PROFIT

Make Your Heating Systems **SARCO** *Throughout*

Sarco inlet valves are of the truly packless type. The stems are sealed with a bellows made from the same seamless, corrugated bronze tubing which has made Sarco radiator traps so successful. No packing of any kind is used, and there is thus no danger of leakage.

Sarco Valves cost no more than other types employing perishable packings—they assure trouble-free service for the life of the system.

The complete Sarco line includes Radiator, Drip and Return Traps, Air Eliminators and Temperature Control. Make your next system Sarco, for permanence with profit.

Ask for Catalog No. 167 or this new data book.

STEAM
HOOK-UPS
54

SARCO

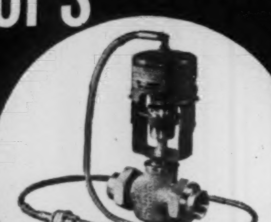
THERMOSTATIC FLOAT AND BUCKET TRAPS
REGULATORS AND HEATING SPECIALTIES

SARCO COMPANY, INC., 183 MADISON AVENUE, NEW YORK, N.Y.
SARCO CANADA, LTD., FEDERAL BLDG., TORONTO, ONTARIO

STOPS OVERHEATED WATER

Reduces Fuel Losses

POWERS Hot Water Tank Regulator



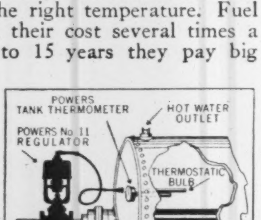
Ends Hot Water Complaints

Pays back its cost several times a year

OVERHEATED water causes complaints, wastes fuel — shortens life of valves and plumbing fixtures and increases deposit of lime in pipes. ● Powers regulators will help to reduce these losses. Install them on your hot water heaters. They keep the water at the right temperature. Fuel savings alone often pay back their cost several times a year. As they usually last 10 to 15 years they pay big dividends. *Write for Bulletin 2035.*

The Powers Regulator Co. Offices in 45 Cities. See your phone directory. 2759 Greenview Avenue, Chicago; 231 E. 46th Street, New York City; 1808 West 8th Street, Los Angeles.

45 *Years of Temperature Control*



POWERS AUTOMATIC WATER TEMPERATURE CONTROL

Even Hot Water Temperatures Assured with

Patterson

Everdur or Copper-Lined Hot Water Heaters

Chart No. 1 shows the temperature of hot water in the Hotel Bethlehem, Bethlehem, Pa., **before** they installed a Patterson Hot Water Heater; and chart No. 2 shows the temperature a few days **after** installation.

You can bank on Patterson Heaters furnishing all the hot water required, as quickly as required and at the temperatures desired. No danger of scalding water, no kicks because water is too cold.

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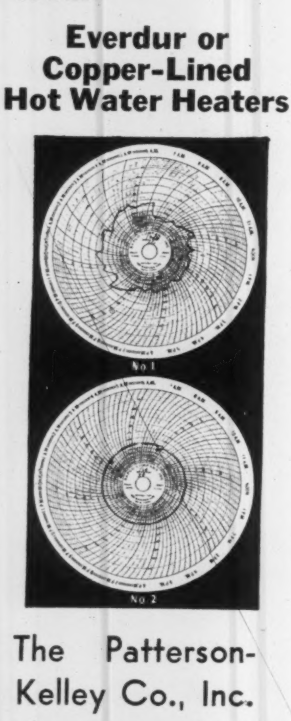
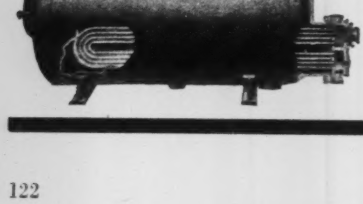




The Patterson-Kelley Co., Inc.
107 Warren St.
East Stroudsburg, Pa.

hibit, June 13-16, Hotel Schroeder, Milwaukee, Wis. Headquarters office, 139 N. Clark St., Chicago, Ill.

American Society for Testing Materials: Annual meeting, June 26-30, Chalfonte-Haddon Hall, Atlantic City, N. J. Headquarters Office, 260 S. Broad St., Philadelphia, Pa.

National District Heating Association: Annual convention, June 27-30, Hotel Pennsylvania, New York, N. Y. Headquarters office, 1317 Spruce St., Philadelphia, Pa.

International Acetylene Congress: 13th International Congress of Carbide, Acetylene, Oxy-Acetylene Welding and Allied Industries, June 25-July 1, Munich, Germany. International Acetylene Association, 30 E. 42nd St., New York, N. Y.

American Society of Heating and Ventilating Engineers: Semi-annual meeting, July 2-5, Grand Hotel, Mackinac Island, Mich. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

American Society of Mechanical Engineers: Semi-annual meeting, week of July 10, San Francisco, Calif. Headquarters office, 29 W. 39th St., New York, N. Y.

American Society of Mechanical Engineers: Fall meeting, week of September 4, New York, N. Y. Headquarters office, 29 W. 39th St., New York, N. Y.

Exposition of Building, Industry and Services: October 4-6, Hotel Statler, Detroit, Mich. (concurrently with annual convention of Mortgage Bankers Association of America). Secretary-Treasurer, George H. Patterson, 111 W. Washington St., Chicago, Ill.

American Society of Mechanical Engineers: Annual meeting, December 4-8, Philadelphia, Pa. Headquarters office, 29 W. 39th St., New York, N. Y.

American Society of Heating and Ventilating Engineers: Annual meeting, January 22-26, 1940, Cleveland, Ohio. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Sixth International Heating and Ventilating Exposition: January 22-26, 1940, Cleveland Public Hall, Cleveland, Ohio. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 126. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 3047. ACETYLENE EQUIPMENT: The Linde Air Products Co., Unit of Union Carbide and Carbon Corp., 30 E. 42nd St., New York, N. Y. 40 p. booklet on cold weather care of acetylene generating and distributing equipment containing valuable suggestions for proper maintenance of acetylene generators and associated equipment subject to freezing.

No. 3048. AIR CONDITIONING: Carrier Corp., 302 S. Geddes St., Syracuse, N. Y. 16 p. quick reference catalog on equipment for air conditioning stores, offices and homes, and including refrigeration and heating equipment. Each type of product is described according to application, function, advantages, operations, installation, dimensions, and sizes.

No. 3049. AIR CONDITIONING: Trane Co., La Crosse, Wis. 8 p. issue of "Weather Magic" (Vol. 2, No. 10) with nontechnical articles on air conditioning radio studios, a tourist camp, and a drug store, and with information on heating a school.

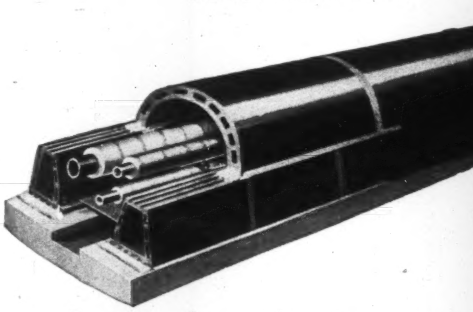
No. 3050. AIR CONDITIONING AND REFRIGERATION: Frick Co., Waynesboro, Pa. 16 p. booklet (670) on air conditioning and refrigeration in New England and Manhattan, illustrating and describing a number of commercial and industrial installations.

No. 3051. BRAZED JOINTS: Walworth Co., 60 E. 42nd St., New York, N. Y. Issue of "Walworth Today" (Vol. 2,

THERM-O-TILE

The Conduit for
Underground Steam Lines

Simplest
Strongest
Most Efficient



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Complete data and estimates on request.

Sold and Installed by Johns-Manville Construction Units in all Principal Cities.

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STANDARDIZE ON
SPORLAN CONTROLLED PERFORMANCE VALVES

and get "Peak Performance" on ALL installations
SPORLAN
Controlled Performance
VALVES

Sporlan CONTROLLED PERFORMANCE valves are the only thermostatic expansion valves with elements charged according to the application of the valve. The selective charges are designed to give the best operating characteristics for each class of installation. Only by using SPORLAN valves can you be assured of PEAK performance on EVERY installation.

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You can install **SPORLAN VALVES WITH CONFIDENCE**

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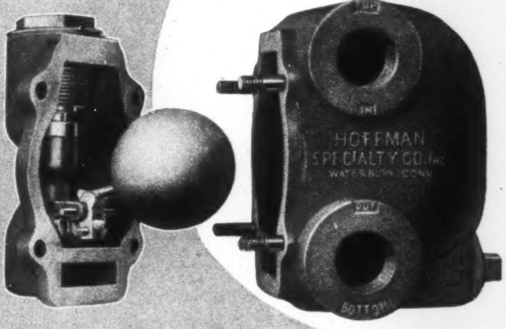
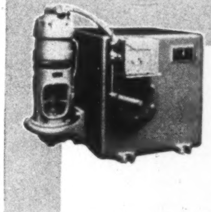
ALL WORKING PARTS
MOUNTED ON THE COVER
FOR EASY ACCESSIBILITY





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A complete line of superior products at no greater cost . . . sold everywhere by leading Wholesalers of heating and plumbing equipment. Write for free catalogs.

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BLOWERS

for Every Size and Kind of Job

US AIRCO
Air Conditioning
EQUIPMENT

Single and double inlet blowers, all types, 300 to 100,000 c.f.m. Backwardly curved blade blowers, 1,000 to 70,000 c.f.m. Everything you need for schools, churches, industrial plants, public buildings, etc. Over 6,000 installations have proven U. S. AIRCO dependability.

Complete Line

U. S. AIRCO also makes single and double stage air washers, unit coolers, unit heaters, blast heat cores, exhaust fans, and U. S. AIRCO Deflecto-Grille, for perfectly controlled air distribution. Our Engineering Dept. gladly cooperates with Architects, Engineers and Contractors on plans and estimates. Send today for U. S. AIRCO catalog showing complete line.

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2135 Kennedy St. N. E.,
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In Canada—Canadian Air Conditioning Co. Ltd., Toronto, Ont.
Export Office—U. S. Air Conditioning International, Inc., 420 Lexington Ave., New York, N. Y.
Eastern Distributor—U. S. Air Conditioning Sales Corp., 420 Lexington Ave., New York City

An Indicating Flow Meter For Less Than $50.00!

MERIAM TYPE "H"

This price includes direct reading scales graduated in any flow units desired; control and by-pass valve manifold with welded steel piping; and indicating fluid (Mercury or Red Oil).

For measuring rate of flow of water, gas, air, steam, etc. on pressures up to 250 lbs. per sq. inch.

Orifice flanges available for any size line, with orifice plates correctly engineered to measure your flows.

Rugged and simple in construction, inexpensive in first cost and upkeep, Meriam Type "H" Flow Meter is an unusual bargain for accurately measuring any gas or liquid flow.

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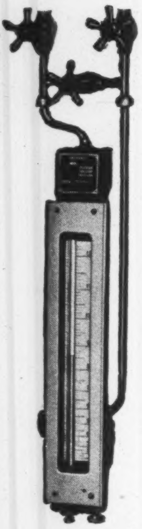
THE MERIAM CO.
Instruments for Indicating Pressure or Flow of Liquids and Gases
CLEVELAND • OHIO



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Anaconda Copper Tubes
Types K—L—M
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ANACONDA
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THE AMERICAN BRASS CO. Gen. Offices: Waterbury, Conn.
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No. 4) devoted principally to "Walseal" silver brazed joints with data on uses and advantages.

No. 3052. CONTROLS: Burling Instrument Co., 241 Springfield Ave., Newark, N. J. Leaflet entitled "A Message About a Heat Dictator" describing briefly temperature controls for a range from minus 100 to plus 1400 F.

No. 3053. CONTROLS: Julien P. Friez & Sons, 4 N. Central Ave., Baltimore, Md. Data sheet (225) announcing hydraulic action solid liquid filled controls; bulletin (TS) on heavy capacity wall, oven and industrial thermostats; bulletin (LC) on boiler, furnace and fan controls; bulletin (TM) on "Microstat" thermostats; bulletin (CS) on stoker control sets and accessories; and bulletin (CR) on refrigeration temperature and pressure controls.

No. 3054. EXPANSION JOINTS: Foster Wheeler Corp., 165 Broadway, New York, N. Y. 4 p. bulletin (X-39-5) on "Type S" stainless steel bellows expansion joints of all welded, all steel construction, which require no adjustments or lubrication by the operator, and which are available in standard pressure series of 50 lb, 150 lb and 300 lb per sq in. and a special series for 600 lb.

No. 3055. FAN BLADES: Torrington Mfg. Co., 70 Franklin St., Torrington, Conn. 4 p. bulletin giving performance ratings against pressure, as recorded under NAFM code, for standard model "Airistocrat" propeller fan blades. Air deliveries in cfm and hp consumption at various speeds are given in terms of static pressure and inches of water ranging from free delivery to 1.5.

No. 3056. GAS FIRED UNIT HEATERS: Dravo Corp., Dravo Bldg., Pittsburgh, Pa. 4 p. bulletin describing and illustrating new suspended type unit heater for gas firing which has a capacity of 500,000 Btu per hr.

No. 3057. LEATHER BELT DRIVES: Chas. A. Schieren Co., 30-38 Ferry St., New York, N. Y. Mimeographed bulletin comparing short center flat leather belt drives and v-belt drives.

No. 3058. LINE STARTERS: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Price list (11-200) on de-ion non-reversing line starters with built-in control circuit transformers for use in stokers, oil burners and for other applications.

No. 3059. MANOMETERS: The Meriam Co., 1955 W. 112th St., Cleveland, Ohio. 20 p. preliminary bulletin (B) on well type manometers for measuring pressure, vacuum, and differential pressure, containing full information on size ranges, operating pressures, scale graduations, accessories and indicating fluids, and with pertinent data on connections and principles of operation.

No. 3060. MOLYBDENUM: Climax Molybdenum Co., 500 Fifth Ave., New York, N. Y. 4 p. issue of "The Moly Matrix" (Vol. 5, No. 12) with information on molybdenum iron and steel in construction of pressure regulators.

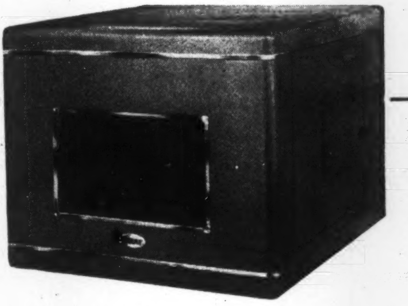
No. 3061. MOTORS: Allis-Chalmers Mfg. Co., Milwaukee, Wis. 8 p. bulletin (1195) on "Lo-Maintenance" squirrel cage induction motors, including case studies of motors operating under adverse conditions and with illustrated descriptions of construction details and a table giving common types of squirrel cage motors and their applications.

No. 3062. MOTORS: Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill. 4 p. issue of "The Motorgram" (Vol. 19, No. 1) including an article on how general purpose motors are rated.

No. 3063. MOTORS: Century Electric Co., 1806 Pine St., St. Louis, Mo. 4 p. bulletin (Manual 21-121) on installation, care and adjustment of fractional horsepower capacitor single phase motors.

No. 3064. MOTORS: Louis Allis Co., 427 E. Stewart St., Milwaukee, Wis. 8 p. bulletin (610) containing general information on NEMA standards and definitions and including suggestions for proper selection of motors, types of drives, types of protected motors and their definitions, information on service factors, rated loads, torques and other data.

No. 3065. MOTORS: Louis Allis Co., 427 E. Stewart St., Milwaukee, Wis. 4 p. bulletin (515) comprising a motor application chart listing 26 different types of motors and checking



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Suspended Type

McQUAY

AIR CONDITIONING UNITS

Incorporating the high efficiency McQUAY cooling coils, multiblade centrifugal fans, and air filters. Housed in an attractive cabinet adaptable for fresh air connection. Furnished using cold water or Freon as the cooling medium.

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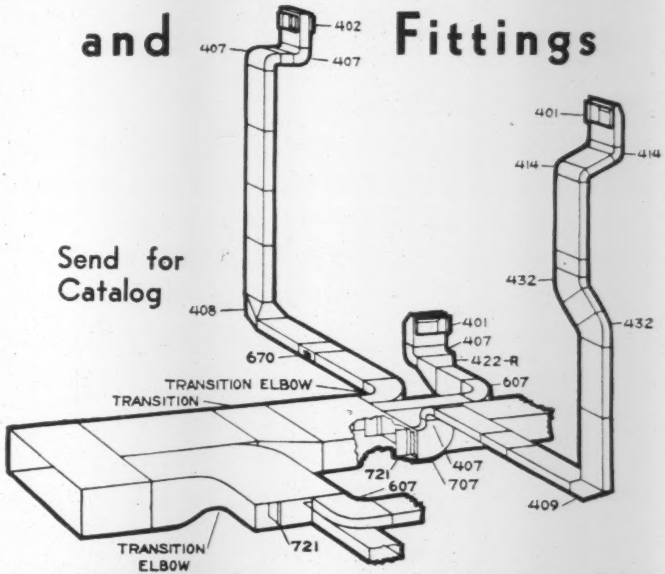
McQUAY INC.

1600 Broadway N. E., Minneapolis, Minnesota

MONCRIEF

Air Conditioning Pipe and Fittings



Send for Catalog

Everything for complete summer and winter air conditioning installations. Made with special Moncrief lock joints. The product of 39 years experience in the manufacture of pipe and fittings. Send for Catalog.

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RANDALL PILLOW BLOCKS ARE QUIET AND EFFICIENT ON ANY UNIT

Through years of unfailing operation of their pillow blocks, Randall has achieved an enviable reputation as a maker of fine bearings for the air conditioning industry. More than a half million Randall Pillow Blocks are now in operation.

To those who want greater dependability and *quiet* pillow block performance we urge a trial of Randalls.

Our engineering department is always ready to cooperate on pillow block problems. Write for 1939 catalog describing in detail our complete line.

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Randall Universal Pillow Block—Has double reservoir and can be mounted in any position simply by unscrewing the oil cup, turning the ball and reinserting the oil cup in a vertical position.

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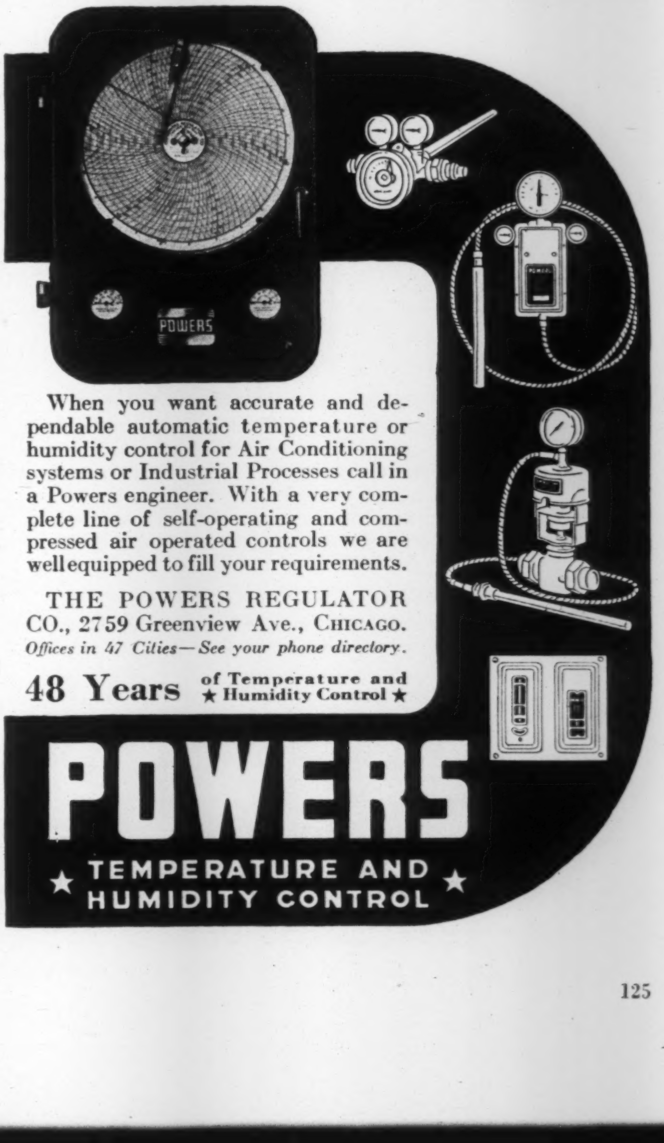

When you want accurate and dependable automatic temperature or humidity control for Air Conditioning systems or Industrial Processes call in a Powers engineer. With a very complete line of self-operating and compressed air operated controls we are well equipped to fill your requirements.

THE POWERS REGULATOR CO., 2759 Greenview Ave., CHICAGO.
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48 Years of Temperature and ★ Humidity Control ★

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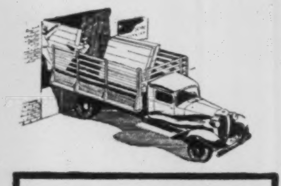
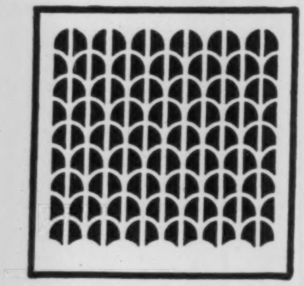
PERFORATED METAL

GRILLES



Arrive on Time



Metals in standard sheets, sizes and gages are kept in stock. Dies are always in condition for use. Wickwire Spencer has the facilities for and realizes the importance of closely following the customers' schedules. In extreme cases, grilles have been shipped within twenty-four hours after all information was in the shop. The buyer of grilles needs this type of service.

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Clinton Grilles are regularly made in various gages of steel, brass, bronze, monel and Wissco Bronze, and are available up to 60″ x 156″ in all finishes. Send for the new GRILLE FOLDER that gives full information.

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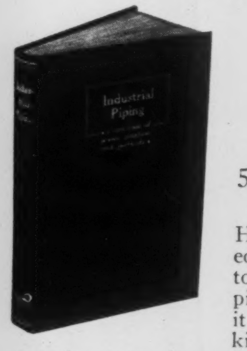
Only $1.00 for This Valuable 285-Page Book on Piping!



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Here is a book that will add the equivalent of years of actual practice to your knowledge of every phase of piping work. From beginning to end it is filled with practical data and kinks on piping design, layout, construction, operation, and maintenance contributed from their experience by nineteen well-known piping engineers. They present to you in this book methods, tables, formulas, and other valuable piping data that it has taken them many years in piping work to develop and perfect. Further, they show you exactly how they have used these methods and data in eliminating faults on existing piping services, and in saving time and expense in the layout and installation of new ones.

There isn't a page in this book that won't give you one or more sound ideas you can put to immediate or future use in improving the efficiency of your own pipe lines. Priced at but $1, it is a rare buy in an engineering book. To get your copy, send $1.00 today to the address below.

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Heating, Piping and Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [2-39]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle numbers in which you are interested):

1611	1612	1613	1614	1615	1616	1617
1618	1619	1620	1621	1622	1623	1624
3047	3048	3049	3050	3051	3052	3053
3054	3055	3056	3057	3058	3059	3060
3061	3062	3063	3064	3065	3066	3067
3068	3069	3070	3071	3072	3073	3074
3075						

Name.. Title..........

Company ....

Address ....

City.. State..........

the proper type of motor recommended by the manufacturer for about 50 standard applications.

No. 3066. PRESSURE REDUCING REGULATORS: Foster Engineering Co., 109 Monroe St., Newark, N. J. 12 p. bulletin (Catalog 70, Bulletin 5) on U-type pressure reducing regulators for water, air and other gases and liquids, describing each of the five types designed to cover a wide range of services and illustrated with wash drawings, line drawings and dimension drawings. A parts list and table of dimensions for each style are also included.

No. 3067. RUST RESISTING SURFACES: American Chemical Paint Co., Ambler, Pa. 4 p. bulletin describing "Dip-Granodizing," a process for creating a rust resisting and paint retaining surface on steel.

No. 3068. SEALS: Frick Co., Waynesboro, Pa. Leaflet describing "Flexo-Seals" for enclosed type ammonia and "Freon-12" compressors, illustrating construction and discussing advantages.

No. 3069. STOKERS: Detroit Stoker Co., General Motors Bldg., Detroit, Mich. 28 p. bulletin on the "LoStoker," a complete mechanical firing unit of the adjustable plunger feed, single retort, side cleaning type. It is built in many sizes and capacities which are given in the booklet together with typical application drawings for a wide variety of boiler types. The booklet describes and illustrates in detail features and installations, gives information on automatic regulation, and other data.

No. 3070. STONEWARE EQUIPMENT: U. S. Stoneware Co., 60 E. 42nd St., New York, N. Y. Looseleaf bulletin (503) on corrosion proof laboratory equipment, laboratory sinks, and acid proof piping.

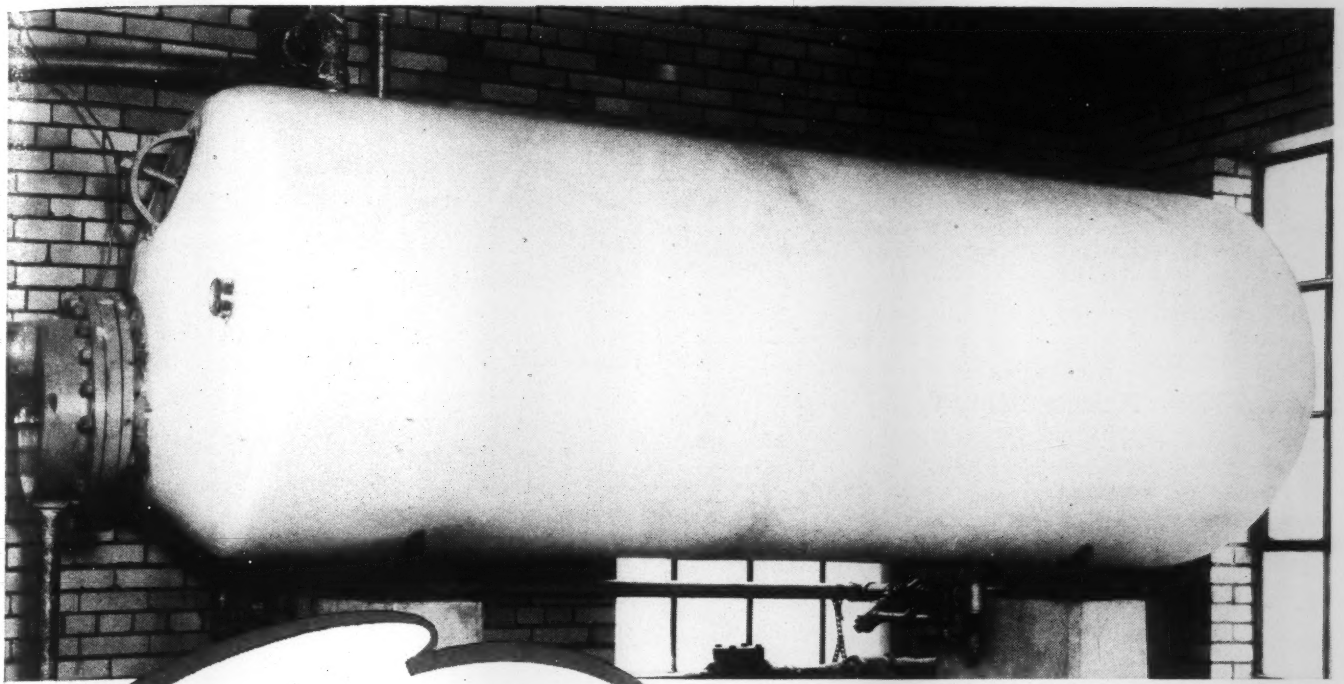
No. 3071. TEXTILE MILL AIR CONDITIONING: Parks-Cramer Co., 970 Main St., Fitchburg, Mass. 16 p. issue of "Parks' Parables" dated January, 1939, on "certified climate" in textile mills, and textile laboratory air conditioning.

No. 3072. UNIT VENTILATORS: Trane Co., La Crosse, Wis. 12 p. bulletin (S340) on unit ventilators, describing and illustrating various features, showing a number of installations, and discussing how the unit ventilator operates.

No. 3073. VALVE RESEATERS: Standard Reseater Corp., 423 W. 126th St., New York, N. Y. Leaflet describing a set of tools for restoring valves to original efficiency by tapping a thread into the old seat metal and screwing in a new renewable seat. Can be used on globe valves, radiator valves, traps, etc.

No. 3074. WATER HEATERS: H. A. Thrush & Co., Peru, Ind. 4 p. pamphlet on cleanable water heaters made in 16 sizes for hot water or steam which are constructed of straight copper tubes within a solid cast iron housing and provide diagonal water flow.

No. 3075. WROUGHT IRON: A. M. Byers Co., Clark Bldg., Pittsburgh, Pa. 55 p. general catalog on wrought iron and steel products containing a wealth of information on specifications, mill standards and pipe measurements, how to order tubular products, identifying markings, dimensional data on pipe and various kinds of tubes and casings, flat rolled products, rolling limits, weights and trade customs. It is fully indexed.



Everdur storage heater recently installed in the City Hospital of Akron, Ohio. Made by THE SIMS COMPANY, INC., Erie, Pa., dimensions 48" x 144", capacity 3500 g.p.h. It serves the hospital laundry.

City Hospital of Akron, Ohio

replaces rustable heaters with

Everdur

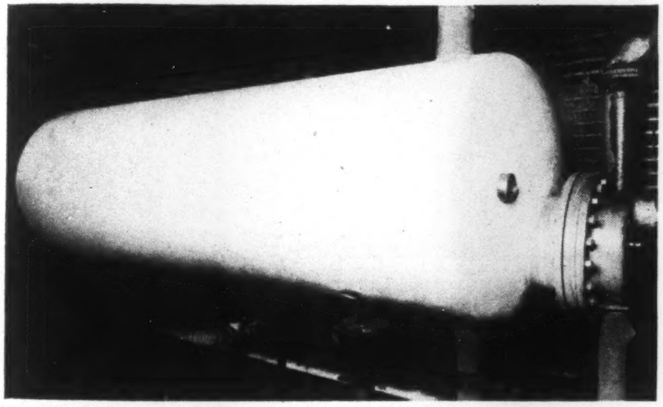
HOSPITALS need an abundance of hot water . . . water without a trace of rust. Besides, limited operating budgets make it desirable to have heating equipment that gives complete freedom from periodic rust repairs. That's why so many hospitals select storage heaters with shells of non-rust Everdur Metal. The City Hospital of Akron, Ohio, is a typical example.

In Commerce, Industry and Homes

All over the country—in schools, department stores, office buildings, textile mills, laundries and various institutions—rustable heaters are being replaced by strong, long-lived heaters made of Everdur Metal. Here are the facts: Nowadays more Everdur tanks and heaters are sold in a week than were built in the entire year 1929.

Everdur—Anaconda's copper-silicon alloy—is rustless, exceptionally strong, welds readily and is moderate in cost. Metals with such a combination of extraordinary qualities are rare indeed. For non-rust tanks and heaters of all types, consult the leading equipment manufacturers. Remember the name—*Everdur Metal.*

3950



Another SIMS Everdur heater installed in this hospital—42" x 144", capacity 2000 g.p.h. It is used for general hospital service.

ANACONDA
from mine to consumer

Everdur TANK METAL

Visit the Copper and Brass Industry Exhibit in the Metals Building at the New York World's Fair 1939. We cordially invite you.

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THE AMERICAN BRASS COMPANY, General Offices: WATERBURY, CONNECTICUT
In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont. • *Subsidiary of Anaconda Copper Mining Company*

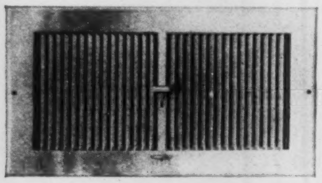
"EVERDUR" is a trade-mark of The American Brass Company, registered in the United States Patent Office.

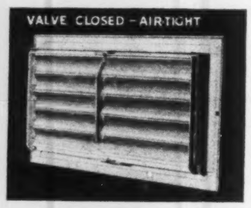
EQUIPMENT DEVELOPMENTS

For your convenience in obtaining more information about any of this equipment, see coupon on page 134. Add the new products and companies listed here to your Directory Section which you received in your January, 1939, HEATING, PIPING AND AIR CONDITIONING and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

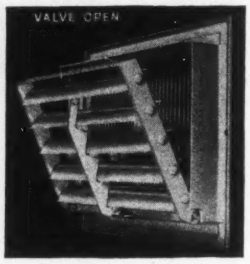
Register With Turning Blade Valve

No. 1625—A new register with turning blade valve offers the following features, according to the manufacturer: (1) adjustable double deflection, which means that the air flow is adjustable sideways, up, or down; (2) uniform distribution over the entire face with uniform velocity; and (3) interchangeability of parts, which permits flexibility of stock as one register face is interchangeable in the four frames required for the various types of installations.





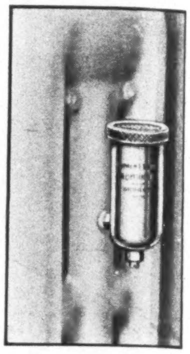
The unique valve, when closed, completely stops the flow of air; when opened, it directs the flow up, straight, or down, as desired. Air flow sideways is controlled by adjustable vertical bars. The register face is divided into two sections by a vertical mullion, with all bars in each section connected to each other.



According to the maker, because the entire face of this design is utilized for the discharge of air, smaller registers may be used without obtaining excessively high velocities over a portion of the face.—Hart & Cooley Mfg. Co., 61 Kinzie St., Chicago, Ill.

Humidifier Valve for Vacuum Systems

No. 1626—Illustrated is a combination humidifier and air vent valve designed for vapor or vacuum heating systems. With pressure at 1 lb in the radiator, one pint per hr of water vapor is discharged into the air, states the maker.



A bronze check in the top of the valve seat prevents air from re-entering the radiator during the time a vacuum is maintained within the heating plant. Steam is filtered and deodorized by two asbestos filters, a silencer and screen. To prevent over-saturation of air during extremely cold weather, the amount of vapor discharged is controlled by means of a simple screw adjustment.—Maid-O'-Mist, Inc., 180 N. Wacker Dr., Chicago, Ill.

Self-Contained Air Conditioners

No. 1627—The new "Yorkaire" self-contained air conditioners include units producing from 2¾ to 15 tons of cooling effect. Engineering developments and modern styling have resulted in

Modern Restaurants use

TRADE FRICK MARK

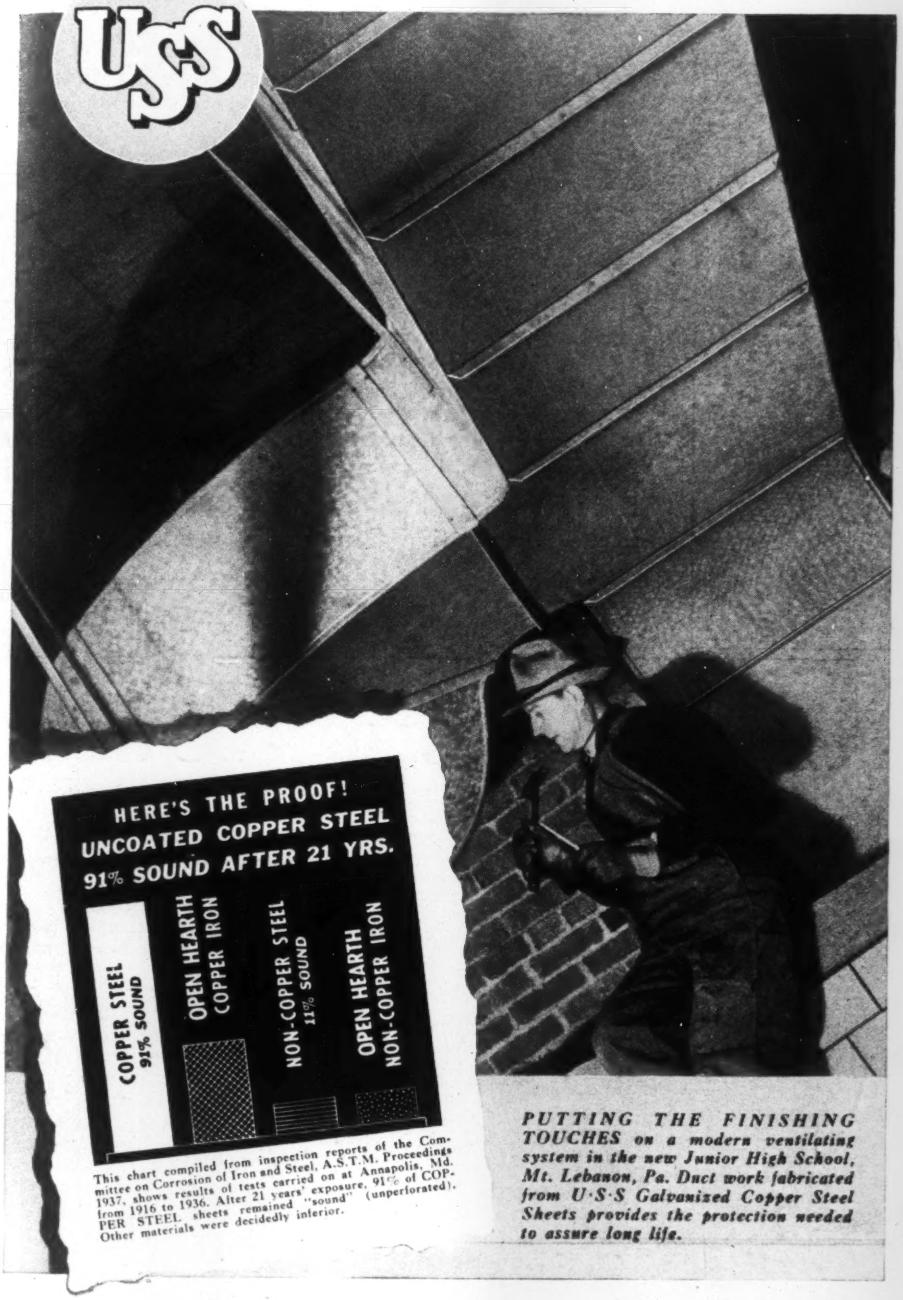
And find they bring all the advantages of quick installation, quietness, large capacity in small space, portability, and economy. Backed by 57 years of Frick experience in refrigerating, air conditioning and ice making work. Get full details about these profit-earning Conditioners today; write, wire or phone

FRICK COMPANY, Waynesboro, Penna.

Unit Air Conditioners

DUCTS OF U·S·S COPPER STEEL SAY:

"*Keep Out*" to Corrosion!



This chart compiled from inspection reports of the Committee on Corrosion of Iron and Steel, A.S.T.M. Proceedings 1937, shows results of tests carried on at Annapolis, Md. from 1916 to 1936. After 21 years' exposure, 91% of COPPER STEEL sheets remained "sound" (unperforated). Other materials were decidedly inferior.

***PUTTING THE FINISHING TOUCHES** on a modern ventilating system in the new Junior High School, Mt. Lebanon, Pa. Duct work fabricated from U·S·S Galvanized Copper Steel Sheets provides the protection needed to assure long life.*

GIVE a "weather man" ducts that resist corrosion . . . and one of his big problems in building trouble-free heating systems is solved. The corrosive atmosphere of most cities and the higher humidities of modern heating systems necessitate the use of steel with greater resistance to rust.

Air conditioning is relatively new. However, the remarkable resistance to atmospheric corrosion of U·S·S Copper Steel, as shown on the chart at the left, should indicate its superiority for this application. We make various types of metal sheets for duct work and, based on extensive experience and a background of the greatest research facilities available, recommend U·S·S Copper Steel as the most durable and satisfactory for this and many other heating and air conditioning uses. The copper addition gives this material much longer life . . . at only a slightly higher cost.

When galvanized metals are specified, U·S·S Copper Steel again proves its superiority. Scratches incurred in handling are less likely to provide a foothold for corrosion when the base metal is copper steel.

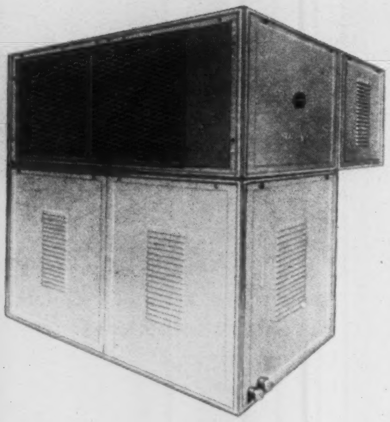
Important, too, U·S·S Copper Steel Sheets are uniform in ductility, gage, size. They're easy to fabricate . . . make possible true bends, tight seams, neat joints . . . and help you to pare money-saving hours from installation time.

The complete story of U·S·S Copper Steels is yours for the asking. Just call our local distributor or write one of the companies below for full information or engineering assistance.

U·S·S COPPER STEEL SHEETS

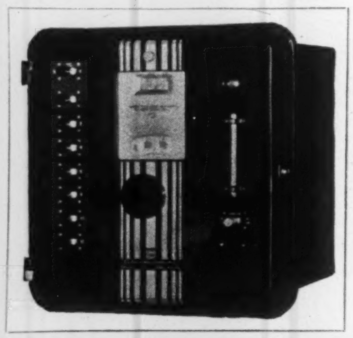
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
Scully Steel Products Company, Chicago, *Warehouse Distributors* · **United States Steel Products Company, New York,** *Export Distributors*

UNITED STATES STEEL



a line of units that require a minimum of space, and have a smart design, the maker points out. The 10 ton model, for example, requires less than 30 sq ft of floor space and stands about 6 ft high. Like the other units, it can be taken through an ordinary doorway. The 5 ton model occupies less than 6 sq ft of floor space and stands about 7 ft high.—York Ice Machinery Corp., Roosevelt Ave., York, Pa.

New Temperature Indicator

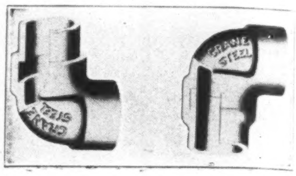


No. 1628—Ample space for toggle-type switches, for connecting any one of a number of couples to the measuring circuit, is provided in a new temperature indicator. Installed wherever convenient, it enables an operator to measure temperatures of near or distant couples with equal reliability, by simply turning a knob, until a pointer comes to zero, and reading a temperature scale.

Separate selector switches can be used external to the indicator, if desired, or space for additional self-contained toggle-type switches may be obtained by assembling the indicator (with case removed) in a cabinet similar to that of the "Micromax" strip chart recorder.—Leeds and Northrup Co., 4970 Stenton Ave., Philadelphia, Pa.

Forged Steel Socket Fittings

No. 1629—A feature of a new line of forged steel socket welding fittings is the deep socket which is designed to provide liberal "come and go" in the assembling of pipe. On installations where the pipe need not butt against the shoulder at the back of the socket, it is unnecessary for the welder to cut the pipe to accurate length or even to cut it off square, the maker states. On installations where the pipe must butt against the shoulder, free uninterrupted flow can be assured conveniently.



The fittings are designed especially for welding, with neat appearing bands only slightly larger than pipe. The socket wall is especially proportioned for welding to assure uniform heat distribution and proper heat penetration.—Crane Co., 836 S. Michigan Ave., Chicago, Ill.

Large Evaporative Condensers

No. 1630—Designed for use with larger type air conditioning systems, a new 150 ton evaporative condenser which can save enough water in 24 hours to fill the average size swimming

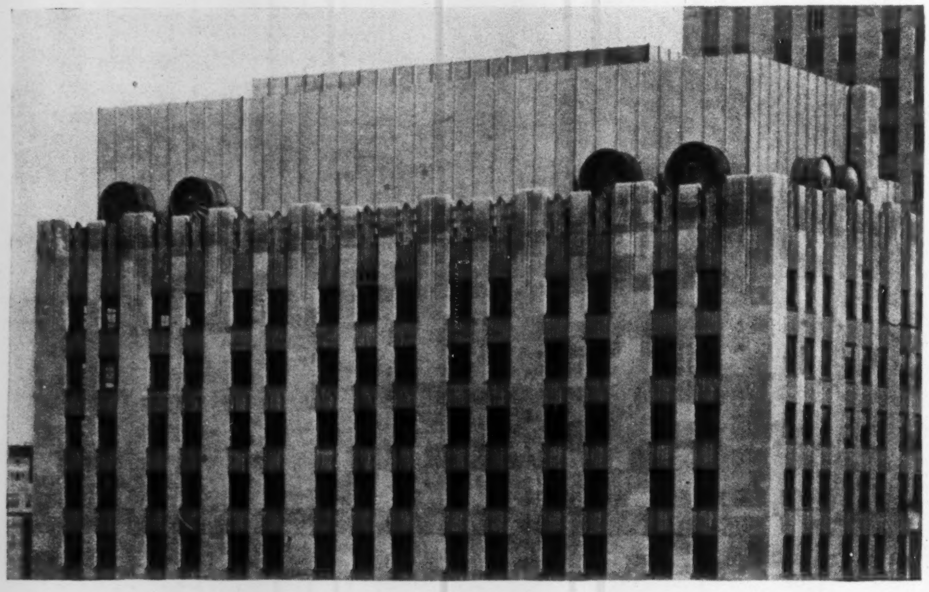
Be Sure with FLUOR COOLING TOWERS

FOR TROUBLE-FREE COOLING EFFICIENCY

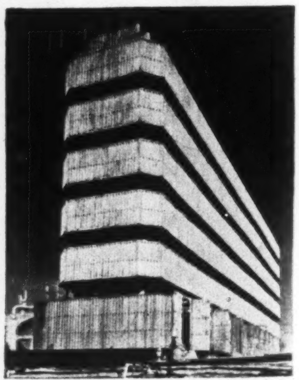
In Air-Conditioning Installations

Each year, in every industry, increased numbers of customers accept Fluor Cooling Towers and cooling equipment as the standard means of process cooling, where water is used as the cooling agent.

You, too, can profit by Fluor's complete water cooling equipment designing, engineering and construction service. Get the benefits of efficient cooling, of construction economy, water economy, space economy, long life and good appearance. Fluor assumes undivided responsibility for every detail. Send for literature today.



Fluor Forced Draft Cooling Tower Installed on Rockefeller Center, New York City.



A complete line of Forced and Induced Draft Mechanical Type Towers, Atmospheric Aerator Type Towers, Spracoolers, Spray Ponds.

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THE COOLING TOWER COMPANY
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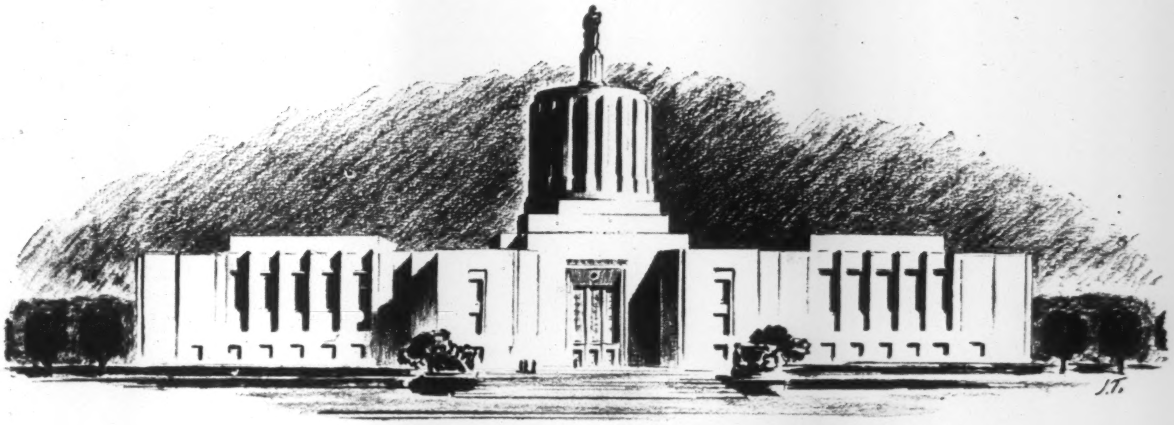
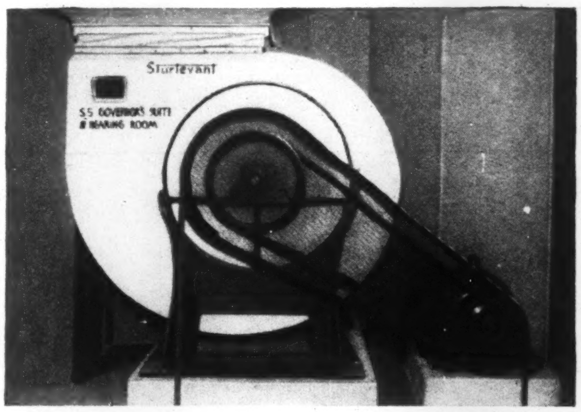
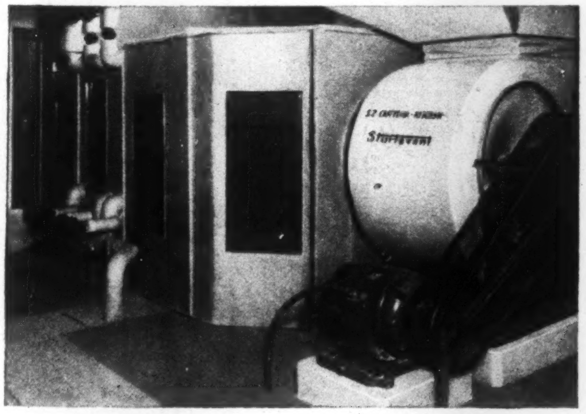


In prize-winning Oregon State Capitol—

STURTEVANT VENTILATING FANS



Photos show two of the 16 Sturtevant Ventilating Fans in the Oregon State Capitol which houses, in addition to two Legislative Chambers—the Governor's Office, Budget Department, Tax Commission and State Land Board.



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FRANCIS KEALLY • ASSOCIATE
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Oregon State Capitol, Salem, Oregon —

Two years ago, on the drafting board . . . the prize-winning design in a nation-wide architectural Competition. Today, one of the outstanding public buildings of the country.

Ventilated throughout by Sturtevant Equipment—Fresh healthful air supplied by 7 giant Sturtevant Supply Fans. Vitiated air removed by 9 Sturtevant Exhaust Fans.

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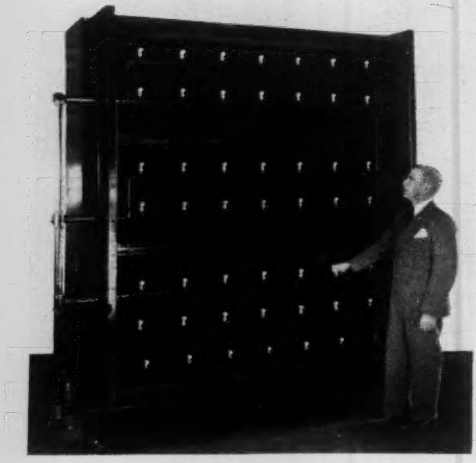
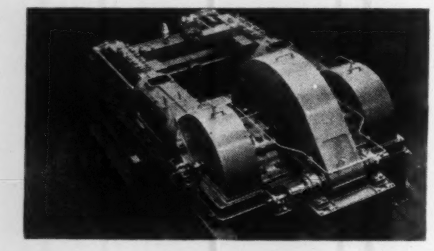
REG. U. S. PAT. OFF.
Puts Air to Work

Fans, Blowers, Air Washers, Air Conditioning, Heating, Vacuum Cleaning, Drying, Mechanical Draft Equipment



pool has been announced. Formerly available in four sizes ranging from 10 to 40 tons capacity, the condensers may now be had in 27 sizes ranging from 10 to 200 tons for "Freon" or methyl chloride. They are completely waterproof for outdoor location without requiring a protective covering or housing.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

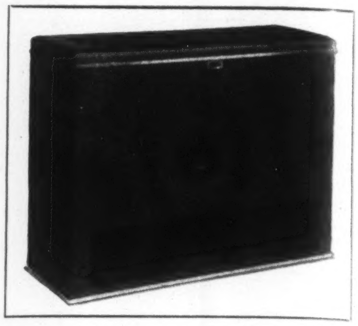
Control for Reciprocating Pumps



No. 1631—For automatic delivery control of high pressure reciprocating pumps, a synchronized unloading and loading device has been developed. Suction valve controlled and air actuated, the mechanism guarantees a quick but gradual decelerating fluid delivery from full flow to zero, and vice versa. In either case the action is the same. The time required for fully unloading or loading any type of multiple plunger reciprocating pump does not exceed one-half of the revolution of the pump.

Among several outstanding claims for the new device, the maker states that it provides positive synchronization of action in loading and unloading, regardless of the point in the pump revolution at which the control functions. The individual cylinders load and unload in sequence on the suction stroke, the action starting with any cylinder.—Worthington Pump and Machinery Corp., Harrison, N. J.

Attractive Unit Heaters



No. 1632—The new "Series F" unit heaters have been designed for heating lobbies, corridors, offices, showrooms and similar places where high capacity, neat appearance and exceptional quietness are desirable, according to the manufacturer. The units consist of centrifugal fans mounted on extended shaft, quiet operating motors, copper fin and tube heating element, all encased in cabinet with rounded corners, finished in black featherweave, trimmed with satin finish stainless steel.

The units are built in four sizes, each of which may be obtained with either high or low temperature heating element. All units are equipped with three speed motors. Capacities based on 2 lb steam pressure and 60 F entering air range from 22,600 Btu per hr for the smallest unit at low speed to 101,500 Btu per hr for the largest unit at high speed. All piping is concealed within cabinets.—John J. Nesbitt, Inc., State Rd. and Rhawn St., Philadelphia, Pa.

..AND BESIDES ALL THAT, IT COMES IN 784 SIZES!

"NOW you're saying something!" is the usual pleased comment when we give out the news that Nesbitt Series H Heating Surface is available in seven distinct surface types, each of which is subdivided into eight fin widths and up to sixteen fin lengths, *a total of 784 available sizes!* Thus, besides its engineering efficiency—"delivering the goods" in all applications up to 200 pounds gauge, from low-pressure heating and ventilating to high-temperature and high-pressure heating or drying, Series H Surface is adaptable to the most varied size requirements. Made entirely of copper and copper alloy it stands up under the corrosive effects of even high-pressure steam. Why not utilize this EXTRA efficiency in your next installation? John J. Nesbitt, Inc., Holmesburg, Phila., Pa.

SOLD BY LEADING MANUFACTURERS OF FAN-SYSTEM APPARATUS

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Send for your copy of our new Publication 232 which contains complete description and engineering data

NESBITT

SERIES H HEATING SURFACE

PRODUCTS ARE DEPENDABLE

AP

THE STANDARD

FAR reaching vision adds to the handiwork of an organization; a priceless ingredient.

People recognize this priceless thing in the products of that organization, and a standard is established.

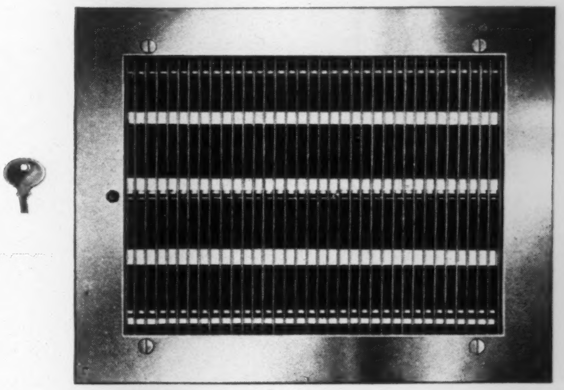
That standard is a dependable product designed to accomplish more than its purpose and used by everyone because it carries the trademark of that organization.

●

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN

DEPENDABLE
THE BY-WORD FOR A-P VALVES

ACCENT ON USE!



- **A NEW CONSTRUCTION**
- **AIRLINE FACE — FIXED DEFLECTION**
- **KEY OPERATOR — POSITIVE SETTING**
- **FACE INSTANTLY REMOVABLE**

Here is a brand new Air Conditioning Multivalve Register. Unobtrusively attractive, it allows for positive "locked" setting of louvres and the Airline — fixed deflection — face is easily and quickly removable. Ask for design No. 7980.

This Register is one of the latest Tuttle & Bailey developments described in catalog No. 39 which is just off the press. If you haven't received **your** copy write at once.

GRILLES
REGISTERS
AIR CONTROLS
Air Conditioning
39
TUTTLE & BAILEY
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T & B

TUTTLE & BAILEY INC.
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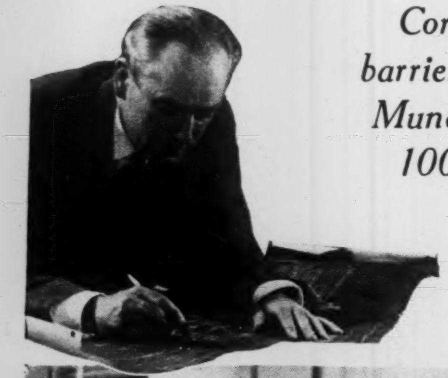
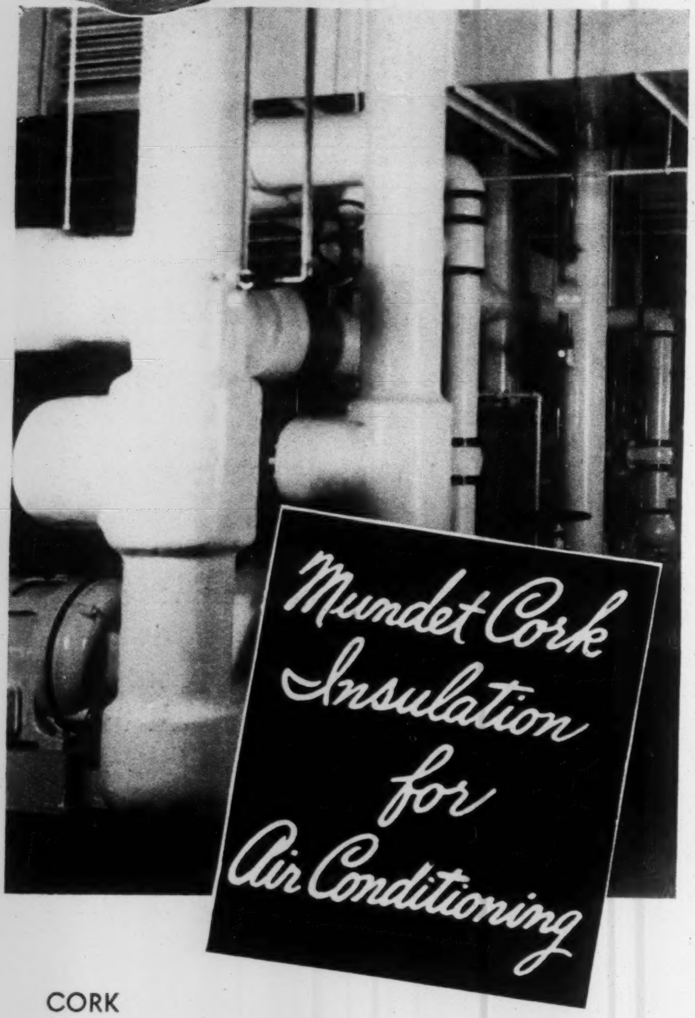


Cork is a natural barrier to heat flow . . Mundet Insulation is 100% pure cork.



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It pays well to specify Mundet Cork Insulation because it offers a natural barrier to heat flow. Unsurpassed for low thermal conductivity, Mundet Cork is moisture resistant, sanitary and long lasting. See our catalog in Sweet's, or write for insulation data.

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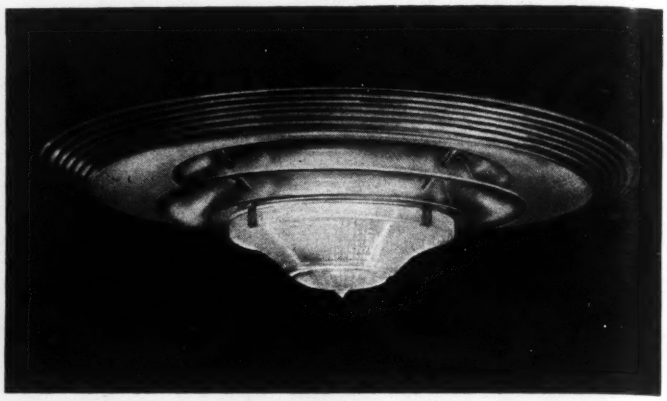
CORPORATION
INSULATION DIVISION
65 S. Eleventh Street, Brooklyn, N. Y.
Offices in Many Cities

Combination Air Diffuser and Light

No. 1633—The new "Anemo-light" is a combination of the "Anemostat" high velocity air diffuser and a built in light which has been designed to provide draftless, even distribution of air and scientific lighting. The section which serves as the air diffuser is of a design and dimensions different from the standard "Anemostat." The largest member has a fluted polished edge and the beaded edges of the inner members are also polished. The complete fixture is of the recessed type, fitting tightly against the ceiling with a minimum projection below the ceiling line. It is spun of aluminum and sprayed with aluminum lacquer.



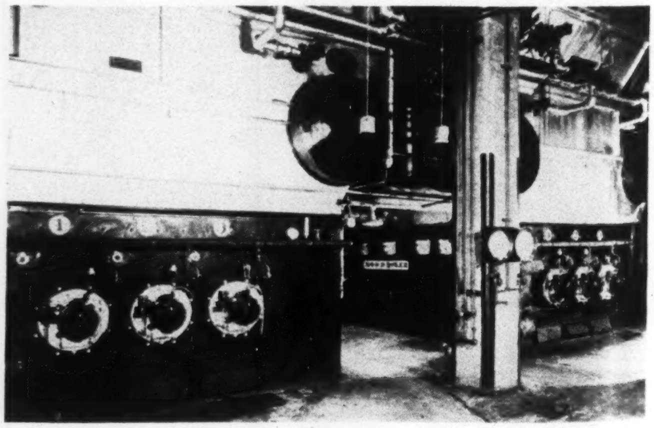
The lighting unit is a "Holophane" reflector refractor. When lighted, a portion of the reflected light is thrown on to the flaring cones of the air distribution section of the device in order to give a luminous quality and feeling of lightness to the entire fixture which is accentuated by the polished edges.

To compensate for the loss of free area in the center of the fixture due to the lighting unit, the design of the largest cone is different from that in the standard "Anemostat" to provide a larger expansion area.—Anemostat Corp. of America, 10 E. 39th St., New York, N. Y.

Variable Capacity Oil Burner

No. 1634—An improved variable capacity mechanical pressure atomizing oil burner has recently been made available. Among its features, which are cited by the manufacturer, are the following: Unlimited firing range without change of burner tips, without change in oil delivery pressure, without change in angle of spray and without loss of atomizing efficiency; automatic control without loss of efficiency over all firing ranges; it maintains constant steam pressure regardless of demand; allows the boiler to follow the sudden and widely varying steam load requirements; operates at a 300 lb working pressure over a severe range up to any rating.

Because of the burner's ability to follow load requirements, and because the capacity curve is a straight line and not a



Why you'll make money with the **CURTIS**
Refrigerated Store and Office Cooler

COMPETITION is forcing all classes of retail establishments, offices, banks, etc., into air conditioning. The public is demanding comfort and alert retailers know it. Now is the time to take advantage of this great, growing market — sell the Curtis Store and Office Cooler.

✓Check These Features!

- ✓ A complete air conditioning system in one compact unit.
- ✓ Mechanically cools, dehumidifies, circulates and filters.
- ✓ Can be delivered and put in operation same day. Entirely self-contained.
- ✓ No drafts, adjustable grilles.
- ✓ Requires only 5½ sq. ft. of floor space.
- ✓ Completely built and tested at factory assuring quiet, dependable operation.
- ✓ Designed for long life, low operating cost, complete satisfaction.
- ✓ Adaptable for heating, if desired.

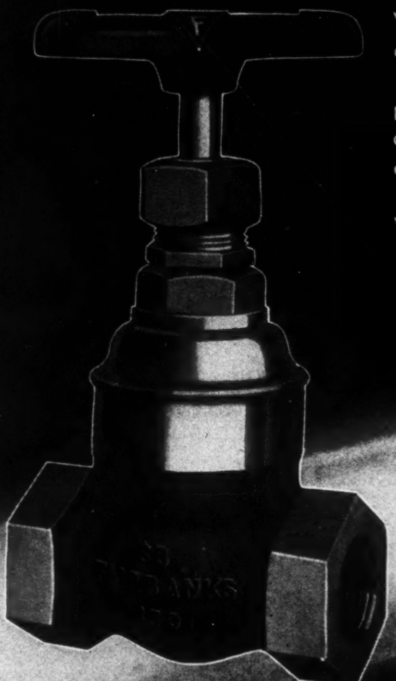
It will pay you to get all the facts on this latest addition to the complete Curtis line. Your market is ready — here's the product that sells it. Wire or write today.

CURTIS
REFRIGERATION
AIR CONDITIONING AND COMMERCIAL

Curtis Refrigerating Machine Company
Division of Curtis Manufacturing Co.
1950 Kienlen Ave. St. Louis, Mo.

"Builders of Condensing Units Since 1922"

Highest Quality Throughout



We make QUALITY our first consideration in the manufacture of Fairbanks Valves, yet they cost no more than other makes. Nothing is spared in the cost of materials and labor to make every Fairbanks Valve as perfect as possible.

Castings are carefully tested to make sure that they are free from imperfections. All parts are carefully gauged to insure perfect fit. And after assembly every valve is subjected to the severest test. Everything must be exactly right before Fairbanks Valves are permitted to leave our factory.

Try Fairbanks Valves and you'll be convinced of their superior excellence. Write now for Catalog No. 21.

THE FAIRBANKS CO.
396 LAFAYETTE ST., NEW YORK, N. Y.
BOSTON, PITTSBURGH • *Distributors in Principal Cities*
Factories: BINGHAMTON, N. Y. • ROME, GA.

UNDER-GROUND INSPECTION

BURYING steam pipes underground, and then hoping for the best, resembles the famous habit of the ostrich. The time to give steam conduit the "once-over" is *before* it goes into the ground, not after. Ric-wiL construction and Dry-paC Insulation are perfectly open to inspection before installation. Investigate, compare—before you buy!

Ric-wiL Conduit for steam power and heating lines is a sectional system built of vitrified, glazed Tile (also furnished in Cast Iron and in Armco Iron Units). Standard Ric-wiL is insulated with patented Dry-paC Waterproof Asbestos, but loose commercial insulation or sectional pipe covering may be had if desired. Ric-wiL with Dry-paC, as proved by reliable tests, gives over 90% efficiency on the line. Upper and lower halves of Ric-wiL Conduit are interlocked by the Loc-liP cemented joint. End joints of conduit and base drain are staggered—another interlocking feature. Ric-wiL provides adequate drainage and entirely closed construction. Complete service on layout, manufacture, and installation. Write for latest bulletins.

The Ric-wiL Co., Union Commerce Bldg., Cleveland, O.
New York Chicago
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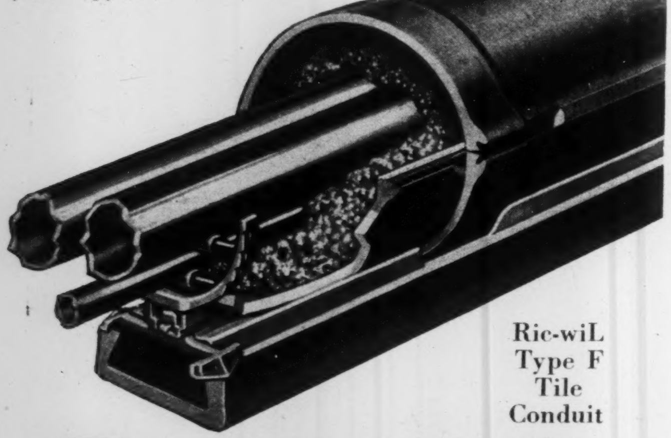
Ric-wiL Bulletin of Steam Heating Rates for 1939 now ready—write for your copy!



Ric-wiL Type F Tile Conduit

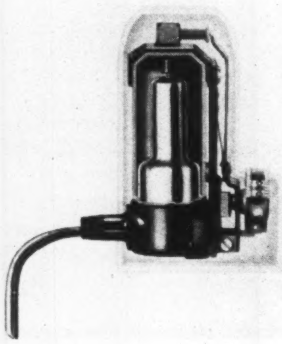
REGISTERED IN U. S. PATENT OFFICE
RIC-WIL
CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

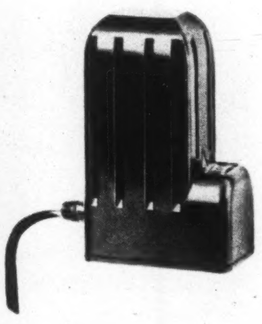
square root curve, and the air flow curve is a straight line, the proper ratio of fuel to air is maintained throughout the entire range of boiler operation, thus maintaining maximum CO$_2$ and resulting in boiler efficiency. Another feature of the burner is that, as the load or capacity is reduced, the returned oil acts as a cooler to the burner tip and thus eliminates carbonization on the face of the tip.

The illustration shows an installation of a battery of these burners.—Todd Combustion Equipment, Inc., Foot 23rd St., Brooklyn, N. Y.

Thermostatic Air Valve

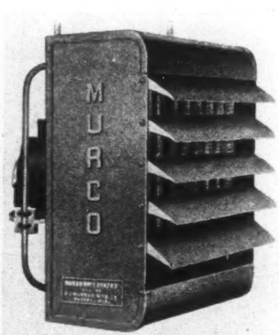
No. 1635**—A new thermostatic air valve for one pipe steam heating systems is designed to give positive individual room temperature control. It replaces the ordinary air valve.





By setting the dial, any temperature between 60 and 80 F can be maintained. Where several buildings are on a district heating line and where the tendency is to overheat the building nearest the heating plant, this valve gives positive control in all buildings and maintains uniform heat, the maker states.—Sullivan Valve and Engineering Co., 929 S. Arizona St., Butte, Montana.

Unit Heater



No. 1636*—A recently developed unit heater, known as the "Murco," has a streamlined casing, and is made in 25 models with capacities from 20,600 to 556,000 Btu and 430 to 8600 cfm. The heating elements are copper tubes that are expanded into high test alloy cast iron headers, so that no strains are set up, according to the maker. The condenser is attached to the casing by a special spring support device so that the condenser is "full floating" to overcome contraction and expansion.—D. J. Murray Mfg. Co., Wausau, Wis.

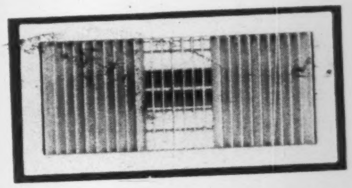
Evaporative Cooling Units

No. 1637—A new inside room cooler and a broader line of "Dezert Koolers" have been announced. The inside cooler uses the evaporative cooling principle and is designed to make installations possible in buildings where window or room coolers are not practical. The cooler is self-contained, with a ¼ in. copper tubing connection to the water supply. The cabinet is die-formed of rust resisting steel, with baked enamel finish and bronze trim.

The 1939 line of "Dezert Koolers" includes seven models, of 1000 to 10,000 cfm capacity. Improvements include a self-contained water recirculating system with separate motor control. The pump is self priming centrifugal type, with "Tennite" impeller that will not wear or collect foreign particles, according

"Camera-Shutter" SIZE CONTROL

An outstanding feature of Waterloo Air Conditioning Grilles is their simple, practical adjustability. With Camera Shutter Size Control, for example, the width and height of a grille opening can be reduced as desired to any size or shape of outlet within limits of grille border. This adjustment can be made at any time to meet varying conditions. In addition to Camera Shutter Size Control, Waterloo also provides 4-way Direction Control, Graduated Volume Control, and the exclusive new Build-Up Selection method which permits numerous combinations of grilles, dampers, and frames for every type of outlet.



New Catalog gives complete details —write for your Free copy today.

WATERLOO REGISTER COMPANY
Waterloo, Iowa
Seattle, Washington

WATERLOO *Air Conditioning* GRILLES

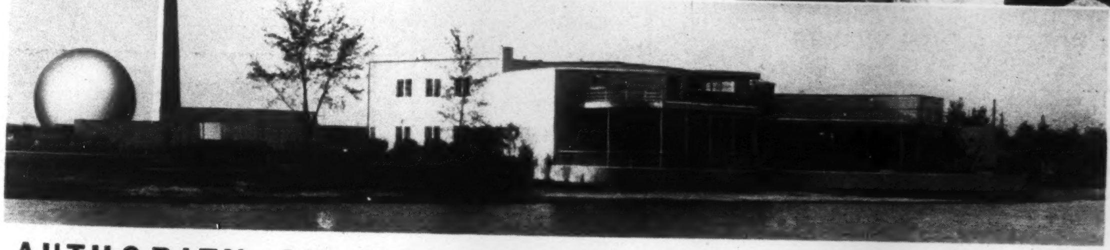
"Fair" Weather BY BAKER

AT THE NEW YORK WORLD'S FAIR

BAKER equipment can solve your toughest installation problems because of the wide range of sizes available and BAKER'S economical efficiency in operation. Freon units are available in 44 different sizes, from the smallest to the largest. Multiple units provide flexible capacity.

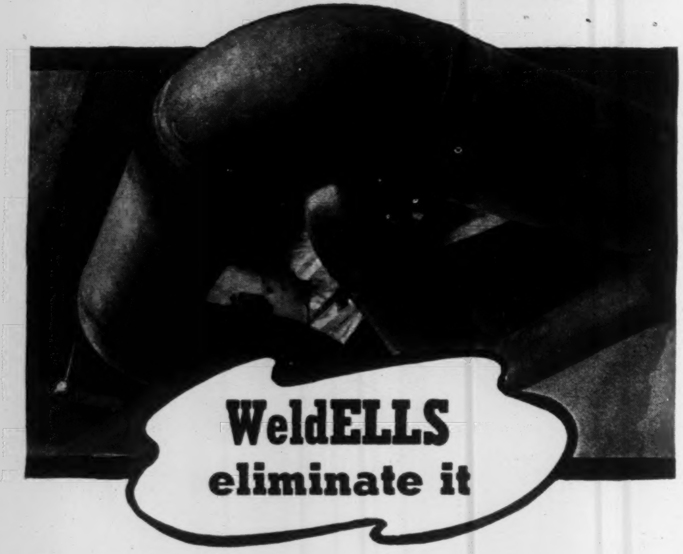
ONLY the most efficient and dependable equipment was acceptable for the luxurious Terrace Club at the New York World's Fair . . . yet economical operation was also essential. Naturally, BAKER System Air Conditioning was selected. Take a tip from the Terrace Club, and specify economical and dependable BAKER equipment for every industrial and commercial air conditioning job.

BAKER
ICE MACHINE CO., INC.
1508 Evans St. Omaha, Nebraska
Branch Factories: Fort Worth, Los Angeles, Seattle. Eastern Sales: New York. Central Sales: Chicago. Sales and Service in all Principal Cities.



AUTHORITY ON MECHANICAL COOLING FOR OVER 30 YEARS

PIPE MAINTENANCE
is a matter of
JOINT MAINTENANCE



THERE is only one pipe joint that actually becomes a *part* of the pipe; that is as *strong* as the pipe; that will *last as long* as the pipe—the *correctly welded* joint.

A correctly welded joint is not made by cut-fit-patch methods. It is made with a welding fitting which permits sound, round-about welds. The key to this kind of pipe joining is the engineered Taylor WeldELLS and other Taylor Forge Welding Fittings.

A good welder takes pride in the kind of job he can turn out when it is made easy for him with these uniformly excellent fittings with their machine-tool-bevelled ends and short tangents. Welded the WeldELL way, the pipe line has smooth stream-lined interiors that reduce flow friction to the minimum, and smooth, sightly exteriors that can be more easily and more efficiently insulated.

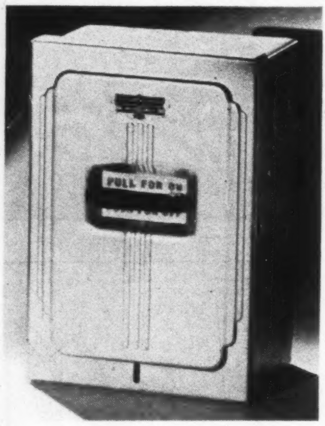
Right now—at the threshold of a new year—is a good time to ring out the old way and bring in the new low-cost way. Remember that the Taylor Forge line contains the largest range of sizes, thicknesses and types of welding fittings made. Convenient stocks are carried in all important industrial centers.

TAYLOR FORGE & PIPE WORKS
General Offices and Works: P. O. Box 485, Chicago
New York Office: 50 Church Street

TAYLOR FORGE
★WeldELLS
Seamless Pipe Fittings for Welding
★ Trade Mark Registered

to the maker. Another improvement is the use of special pad construction to prevent settling or slipping, with chromium grilles over the pad surface. — Utility Fan Corp., 2528 Santa Fe Ave., Los Angeles, Calif.

Enclosed Switch

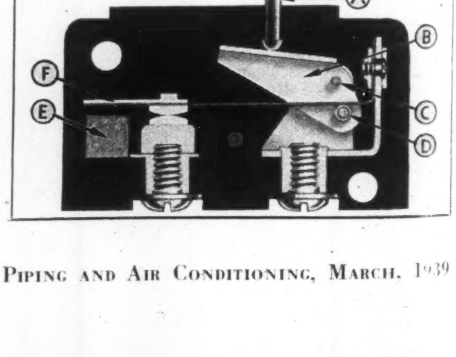


No. 1638—A front-operated enclosed switch—the "D-Puller"—is rated at 30-amperes; the complete line consists of devices for two and three wire solid neutral service, and two pole, 250 volt switches. They are available with and without dead front plates.

The switching mechanism of this line is operated on the "push-pull" principle by a sturdy, non-warping bakelite handle. The "air styled" case—7½ in. high, 5 in. wide and 2¾ in. deep—provides generous wiring space.—Cutler-Hammer, Inc., N. 12th St. and W. St. Paul Ave., Milwaukee, Wis.

Compact Snap Switch

No. 1639—A switch action which was originally developed as a part of low water cut-offs has been made the basis of a "snap" switch of the compact, low operating pressure, short travel type, and is available in a number of types as original equipment for manufacturers using switches of this kind. The basic consideration in the design of the switch was to accomplish a quick make or break with a wide air gap, while still retaining the advantages of highly sensitive, short movement operation, the maker states. The sectional illustration shows how this has been done. The plunger *A* acts on the lever *B* which is pivoted at point *C* so that the roller *D* communicates the operating action to the under side of the special alloy spring *F* on which one of the contacts is mounted. At the end of the spring there is an iron armature which is attracted to the permanent "Almico" magnet *E*. This magnet holds the switch in contact until the point is reached where the pressure on the spring overcomes the pull of the magnet. At this point (characteristic of a magnetic field) the spring kicks to its upper limit instantaneously. Similarly, when closing, the action is instantaneous

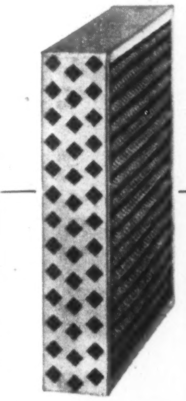


YOU CAN HAVE BOTH IN AIR-MAZE

The two prime essentials of perfect air filtration — (1) positive stoppage of dust, pollen and germs, and (2) practically unrestricted flow of clean, pure air—are *both* yours with AIR-MAZE Permanent, Cleanable Air Filters. For added measure you also get exceptional economy.

The result of more than 15 years' experience in solving air filtration problems, AIR-MAZE employs an unique application of the baffle-impingement principle, through a scientific arrangement of graduated mesh screens, insuring highest efficiency.

AIR-MAZE filters are economical because they need not be replaced during the life of the air conditioning equipment. No maintenance expense except occasional cleaning and recharging with ordinary oil — a simple process. AIR-MAZE panels can be furnished in any reasonable size and shape for any requirement.



CONSIDER THESE FEATURES

- 99.3% to 99.83% Efficient
- Easily Cleaned, Charged
- Very Low Pressure Drop
- No Replacement Needed

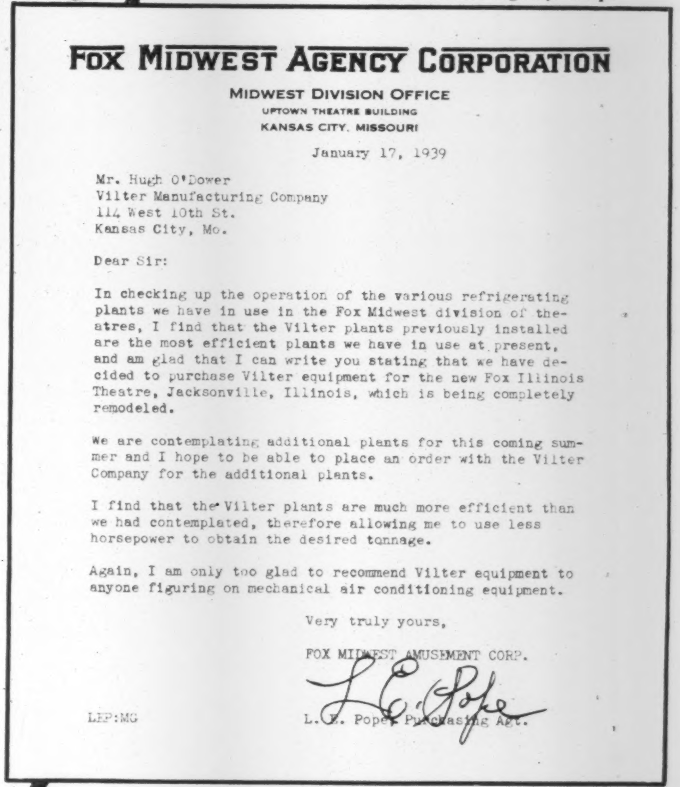
Tell us about your filter problems; no obligation for our recommendations. AIR-MAZE Bulletin PPS-38 is yours for the asking.

AIR-MAZE CORPORATION
5200 Harvard Ave., Cleveland, Ohio

AIR-MAZE
CLEANABLE AIR FILTER PANELS

"I find that VILTER Plants previously installed are the most efficient plants we have in use at present"

L. E. POPE
Purchasing Agent
Fox Midwest Agency Corp.



FOX MIDWEST AGENCY CORPORATION
MIDWEST DIVISION OFFICE
UPTOWN THEATRE BUILDING
KANSAS CITY, MISSOURI

January 17, 1939

Mr. Hugh O'Dower
Vilter Manufacturing Company
114 West 10th St.
Kansas City, Mo.

Dear Sir:

In checking up the operation of the various refrigerating plants we have in use in the Fox Midwest division of theatres, I find that the Vilter plants previously installed are the most efficient plants we have in use at present, and am glad that I can write you stating that we have decided to purchase Vilter equipment for the new Fox Illinois Theatre, Jacksonville, Illinois, which is being completely remodeled.

We are contemplating additional plants for this coming summer and I hope to be able to place an order with the Vilter Company for the additional plants.

I find that the Vilter plants are much more efficient than we had contemplated, therefore allowing me to use less horsepower to obtain the desired tonnage.

Again, I am only too glad to recommend Vilter equipment to anyone figuring on mechanical air conditioning equipment.

Very truly yours,

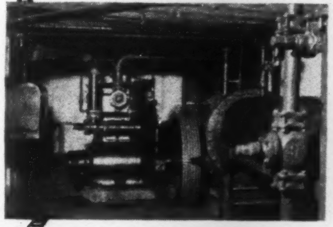
FOX MIDWEST AMUSEMENT CORP.

L. E. Pope

LEP:MG
L. E. Pope, Purchasing Agt.

Daily experience of users confirms the fact that Vilter's superior efficiency actually "*allows the use of less horsepower* to obtain the desired tonnage."

This is distinct tribute to Vilter's advanced engineering and design . . . Giving users everywhere economical costs in compact "space miser" units.

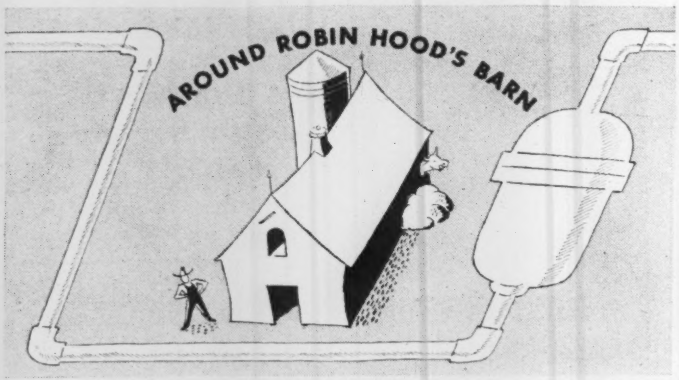


A typical Vilter Air Conditioning installation at Liberty Theatre, Sedalia, Mo.

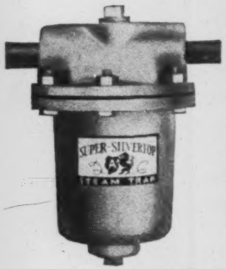
Interior of Liberty Theatre at Sedalia, Mo., one of the many Fox Midwest Theatres using Vilter Air Conditioning.

Superior Since 1867
VILTER
Air Conditioning
Refrigeration . . .

THE VILTER MFG. COMPANY
2148 S. First St.
Milwaukee, Wis.



or STRAIGHT-TO-THE-POINT with ANDERSON SUPER-SILVERTOPS?

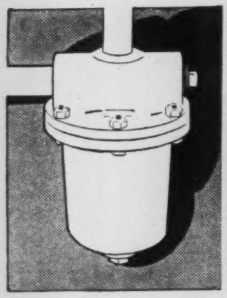


Does your piping go all the way around Robin Hood's barn to get to the steam trap? Then decide now to stop that waste in parts and labor necessary with old fashioned piping. Use Anderson Super-Silvertop steam traps with simplified "straight-to-the-point" piping.

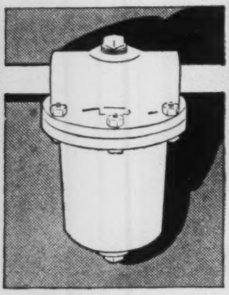
Designed to save you money, Super-Silvertops are engineered to give you many advantages at no extra cost. Super-Silvertops are installed straight-in-line or as an elbow; no extra fittings to buy or install. Extra capacity usually allows you to choose a smaller, less expensive Super-Silvertop than would be required using ordinary traps. Guided bucket saves trap wear, increases bucket life. Inspected right on the line, Super-Silvertops save on inspection time.

These engineered steam traps do more for you but cost no more money (often less). Write today for the complete story, capacities and prices.

THE V. D. ANDERSON CO.
1949 West 96th St. • Cleveland, Ohio



Anderson Super-Silvertop steam trap installed as an elbow. Notice simplicity and saving in fittings and labor.



This view shows same trap installed straight-in-line with the same simplicity, same saving in fittings and labor.

Super-Silvertops are easily opened for inspection without disturbing pipe connections. This means further savings.

Anderson SUPER-SILVERTOP

when the spring comes within the influence of the permanent magnet.

The switch will operate on both d-c and a-c current. The operating force required to open or close the switch is as low as 3 oz, but types are available with operating pressures as great as 12½ oz. Plunger movement may be as short as 0.005 in. or as long as 0.014 in.—McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill.

Booklets, Reports and Papers

Humidity Insulation

Donald C. McSorley of Michigan State College was recently given an ASME student award for his paper on humidity insulation. The material reported was gathered by the author over a period of six months in an investigation originally started by the mechanical engineering department at Michigan State.

The method of calculating moisture transfer through a wall used in the paper is based on the similarity between heat transfer and vapor transfer. By application of an analogy between vapor and heat transfer, formulas and equations are developed to calculate a wall under various conditions for vapor transfer just as a wall can be calculated for heat transfer. As in calculating a wall for heat transfer temperatures on the inside and outside and heat conductivities for the materials making up the wall must be known, in the method used for calculating the wall for vapor transfer it is necessary to know vapor pressures on the inside and outside and vapor conductivities for the various wall materials.

The author therefore gives tables of vapor conductivities of materials as determined to date and describes the test apparatus used in obtaining the coefficients. In conclusion, the paper makes use of the presented data to calculate some walls and see if condensation will occur in them. It is pointed out that condensation is much more apt to occur in an insulated structure than in an uninsulated one because the insulation causes a high temperature drop through the stud space.

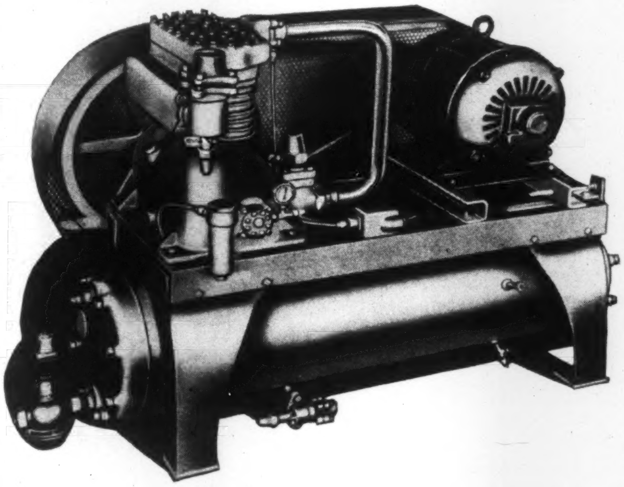
From the material presented the author concludes that (1) vapor transfer through a wall can be calculated in a manner similar to heat transfer, (2) it is possible to get condensation in a wall, (3) it is possible to prevent condensation by the use of a proper vapor barrier on the inner surface of the wall, (4) that in actual conditions the only time that condensation might occur would be during a protracted cold period, but that walls should be designed so that condensation will never occur.

Mr. McSorley states that the amount of vapor going through a wall calculated by the method he presents checks very well with the values for overall structures obtained by Professor Rowley at Minnesota.

Atmosphere and Efficiency

Improving employee relations and efficiency are live problems and influences that affect employee morale are constantly being subjected to study. One of these, air conditioning, was recently analyzed in a survey completed for the York Ice Machinery Corp., York, Pa., and reported in an attractive booklet entitled "Atmosphere and Efficiency.". The survey was conducted by two research organizations, the Psychological Corp., and the Hooper-Holmes Bureau, Inc.

Air conditioning—how does it affect employee efficiency, do employees like it, does it improve their relations with fellow-employees and employer—these and similar questions are of significance to business men, *whether or not* they have installed air conditioning equipment in their establishments. The survey was instituted in order to obtain information on the connection between air conditioning and employee efficiency and disposition.



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Recognized by leading authorities the world over for the high quality of their products, Universal Cooler Corporation has secured and maintained a position as supplier "by appointment" to many of the largest and best known manufacturers of refrigerating and air conditioning equipment.

MANUFACTURERS: Universal Cooler condensing units are made exclusively for you. They are not sold to distributors, dealers, contractors, or users. Universal Cooler's product and policy are suited to your needs. Make our factory *your* factory.

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CONTRACTORS: Universal Cooler condensing units are available to you through our customers, the leading manufacturers of refrigerating and air conditioning equipment. We do not compete with you for business.

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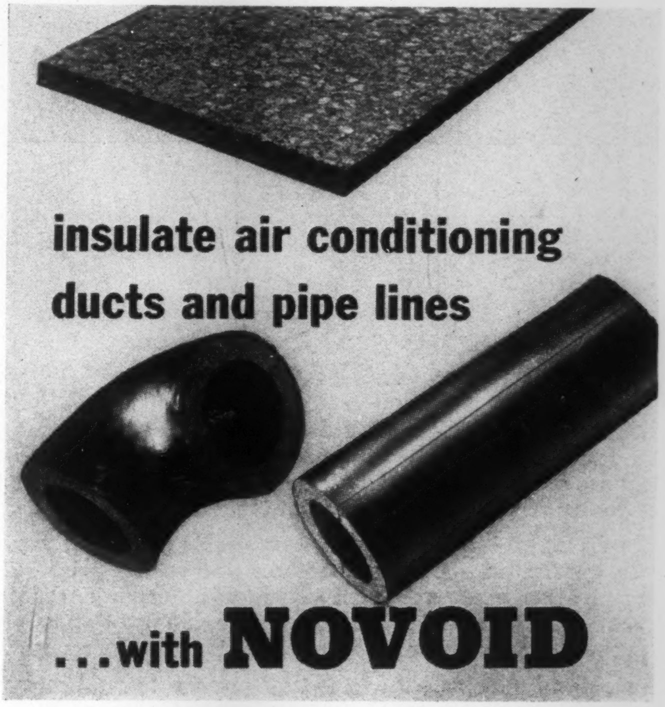
with maximum efficiency



NATURE knows no better insulation than the bark of the cork tree. That's why Novoid Cork Insulation offers maximum efficiency and economy in guarding air conditioning ducts and piping.

Novoid Corkboard provides lasting protection for square and rectangular cold air ducts. It also prevents heat transfer at air washers, dehumidifiers, and connections. Novoid Cork Covering is equally efficient for insulating cold water risers, return lines, and attendant air conditioning piping.

Let Novoid help you deliver cool air more efficiently, at lower cost. Mail the coupon for complete information. Cork Import Corporation, 330 West 42nd Street, New York City.

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Please send me complete details of Novoid Cork Insulation for air conditioning ducts and pipe lines.

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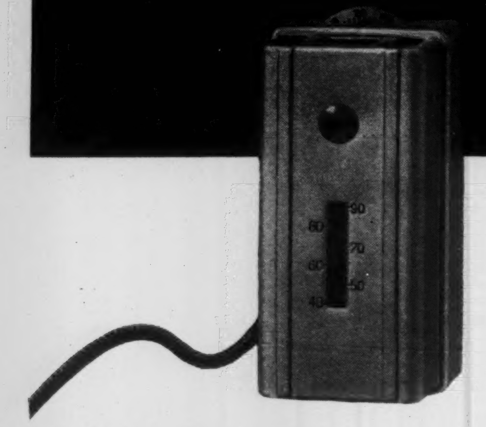

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Merely replacing ordinary radiator valves in each room to be controlled—or the main steam valves to a building floor or zone—they automatically regulate the amount of steam admitted to the radiators to provide uniform temperature of predetermined degree at the breathing line.

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This system is noiseless. There are no levers, no commutators, no wearing parts, no compressed air, no mechanism to adjust or lubricate. It is guaranteed to be trouble-proof. Write for Bulletin EE-70.

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KNOXVILLE, TENNESSEE
Representatives in All Principal Cities in U.S.A. and in Montreal, Canada and London, England

FULTON Sylphon FOR TEMPERATURE CONTROL

The survey conclusions pertaining to employee relations are here given and it is evident that air conditioning influences employee morale and efficiency.

In response to the question, "With air conditioning do you find work less tiring on hot days?", 94 per cent of the employees interviewed gave an affirmative reply. 95.6 per cent said most of their fellow-workers favored air conditioning, and 83.6 per cent declared air conditioning made their fellow-workers less irritable and easier to get along with.

90 per cent gave an affirmative response to the query, "Can you (with air conditioning) do more work on hot days?"

"Is your boss more pleasant," produced a 58.8 per cent affirmative reply. 18.6 per cent said the boss was always pleasant, and 16.6 per cent stated air conditioning made no change in the boss. The remainder gave no answer.

Similar results were received from the management interviews. 94.6 per cent of the executives interviewed stated that air conditioning increases the efficiency of their employees. 77 per cent stated that it increases the amount of work done. Air conditioning reduces hot weather fatigue, declared 93 per cent.

Typical comments from the survey follow:

"When I compare the attitude of employees in other companies with our own people, I see much more harmony here." (Bank official.)

"Prior to air conditioning installation, fainting from excessive heat on sales days was prevalent. At one time they had as many as twelve ambulance chairs working all day with employees and customers fainting left and right." (Department store executive.)

"It definitely reduces irritability, and we all get along better as an organization." (Vice president and store manager.)

"It has worked wonders with the disposition of the many employees here, including the manager." (Stenographer, office building.)

"I know there isn't a man in this department that could do much work without it." (Salesman, men's clothing.)

"Can do twice as much work." (Restaurant waitress.)

"They all like it—it's unanimous. Those that do not work in it want to." (Office building employee.)

"I look forward to getting here in the morning." (Bank cashier.)

Conventions and Expositions

Air Conditioning Conference: March 8-9, University of Illinois, Urbana, Ill. Sponsored by Department of Mechanical Engineering and the Engineering Experiment Station. Chairman, Prof. W. H. Severns, University of Illinois, Urbana, Ill. Papers to be presented include Equipment for All-year Air Conditioning, by W. H. Severns and P. E. Mohn; Characteristics of Duct Systems and Fans, by S. H. Downs; Introduction and Diffusion of Conditioned Air in Rooms, by D. W. Nelson; Regulation of Air Temperature and Humidity, by C. L. Ringquist; Physiological Responses of the Body to Its Environment, by Dr. Charles Sheard; The Cooling Load and Refrigerating Problems in Comfort Air Conditioning, by R. E. Gould; Building Insulation Types and Applications, by S. Konzo; Condensation Problems in Modern Buildings, by L. V. Teesdale; Air Conditioning Water Supply and Disposal, by W. D. Gerber; and Conservation of Water by Using Cooling Towers and Evaporative Condensers, by S. I. Rottmayer.

American Society for Testing Materials: Regional meeting, March 8, Deshler-Wallick Hotel, Columbus, Ohio. Headquarters Office, 260 S. Broad St., Philadelphia, Pa. Program includes Symposium on Thermal Insulating Materials with papers on Factors Influencing Thermal Conductivity, by J. B. Austin; Methods of Testing Insulation, by H. H. Rinehart; One Consumer's Problems in Selecting Heat Insulation, by E. T. Cope and W. F. Kinney; and Effect of Solar Radiation on Heat

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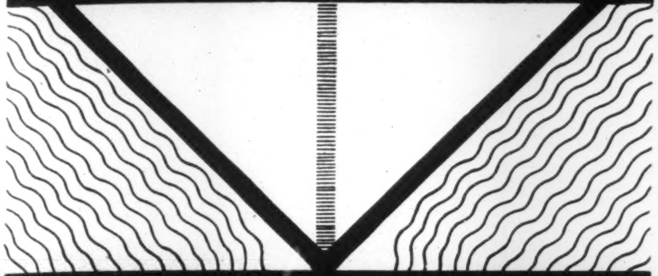

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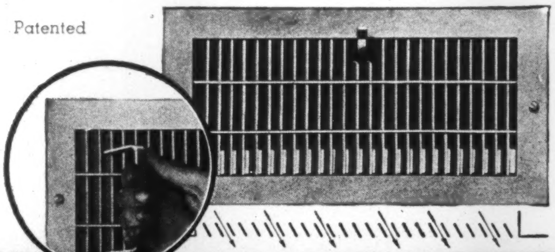

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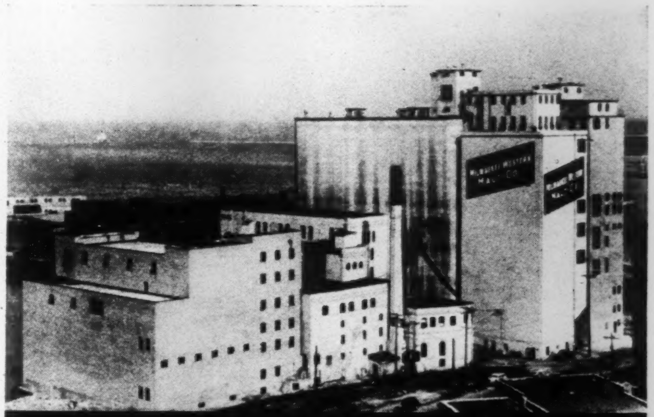

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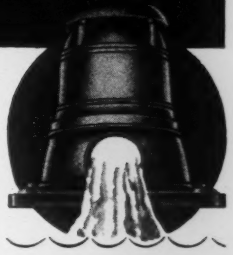

"NOT less than 900 Gallons per Minute" said Layne-Northwest Company's contract for a new well and pump unit for the Milwaukee Western Malt Company's new plant. When drilled to 1740 feet deep, the pump set and tested, the production was 1,000 gallons per minute—or a bit more than 10% above the guarantee. The entire contract was awarded to Layne-Northwest Company on a non-competitive basis, though another well firm had done previous work.

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When considering a new water supply or rehabilitation of your present wells or pumps, Layne will investigate your problem and submit estimates without obligation. Write for bulletin.

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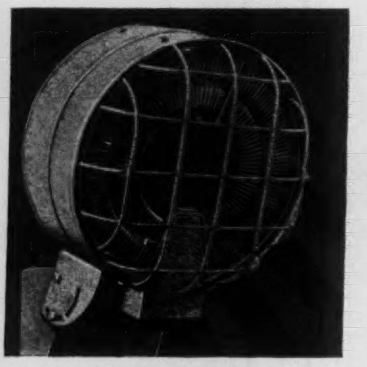

Above: Type UB

Chromalox Electric Unit Heater, usually used for plant heating, showing how it can be inclined at any required angle. Supporting bracket may be bolted to either vertical or horizontal surface. Made in sizes from 2 to 20 Kw. Other types available, for various requirements.

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You'll lose fewer BTU's. from furnace to register. if your air ducts are wrapped with OZITE Air Duct Insulation . . . it gives lasting protection against heat loss in winter and heat penetration in summer . . . makes every kind of air-duct system more efficient. less expensive to operate.

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ONLY 0.246 BTU's

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International Acetylene Association: Annual convention, March 8-10, Rice Hotel, Houston, Texas. Headquarters office, 20 E. 42nd St., New York, N. Y.

Air Conditioning Conference: March 23-25, Oregon State College, Corvallis, Ore. General chairman, E. C. Willey, Oregon State College, Corvallis, Ore. Papers to be presented include Cooling Loads and Methods, by John James; Design of Air Systems, by O. W. Kothe; Types of Heating Systems, by Lincoln Bouillon; Temperature and Humidity Control Methods and Devices, by J. E. Robb; Air Conditioning for Health and Comfort, by John B. Lagen; Estimating Furnace Installation, by E. E. Carroll; Estimating Piping and Central Plants, by Albert Freeman; Estimating Sheet Metal Work, by R. T. Moore; The Architect's Slant on Air Conditioning, by A. Glenn Stanton; Principles of Selling, by B. W. Farnes; Air Systems, by W. R. Burton; Steam Heating Systems, by Walter Paulsen; Oil Burners, by E. W. Neubauer; Gas Burners, by A. E. Finlay; Refrigeration, by F. H. Stephens; Coal Stokers, by Haskell Carter; and Tests for Combustion Efficiency, by W. H. Martin.

Air Conditioning Conference: April 14-15, University of Texas, Austin, Texas. Papers to be presented include Summer Comfort Cooling Requirements for the Southwest, by A. J. Rummel; Fan Selection and Use of Ducts, by J. R. Bishop; Heat Chart Method for Determining Conditions in an Air Conditioning System, and as an Aid for Selection of Equipment, by E. P. Renouf; Case Problems of Air Conditioning, by Dale S. Cooper; Installation, Maintenance, and Service of Air Conditioning Systems, by John B. Groseclose; and Installation and Servicing of Air Conditioning Equipment of Less Than 50 Tons, by A. F. Avera.

American Society of Refrigerating Engineers: Spring meeting, May 22-23, Hotel Hershey, Hershey, Pa. Headquarters office, 37 W. 39th St., New York, N. Y.

Association of Gas Appliance and Equipment Manufacturers: Annual convention, May 24-26, Roosevelt Hotel, New York, N. Y. Headquarters office, 60 E. 42nd St., New York, N. Y.

Heating, Piping and Air Conditioning Contractors National Association: 50th annual convention, May 31-June 2, Drake Hotel, Chicago, Ill. Headquarters office, 1250 Sixth Ave., New York, N. Y.

Stoker Manufacturers Association: Annual convention, June 1-2, French Lick Springs, Ind. Headquarters Office, 307 N. Michigan Ave., Chicago, Ill.

National Warm Air Heating and Air Conditioning Association: Mid-year meeting, June 5-7, Stevens Hotel, Chicago, Ill. Headquarters Office, 50 W. Broad St., Columbus, Ohio.

American Pulp and Paper Mill Superintendents Association: Annual convention and exhibition, June 13-15, Wardman Park Hotel, Washington, D. C. Convention Manager, G. W. Craigie, 176 Mason St., Cumberland Mills, Me.

Smoke Prevention Association: Annual convention and exhibit, June 13-16, Hotel Schroeder, Milwaukee, Wis. Headquarters office, 139 N. Clark St., Chicago, Ill.

American Society for Testing Materials: Annual meeting, June 26-30, Chalfonte-Haddon Hall, Atlantic City, N. J. Headquarters Office, 260 S. Broad St., Philadelphia, Pa.

National District Heating Association: Annual convention, June 27-30, Hotel Pennsylvania, New York, N. Y. Headquarters office, 1317 Spruce St., Philadelphia, Pa.

International Acetylene Congress: 13th International Congress of Carbide, Acetylene, Oxy-Acetylene Welding and Allied Industries, June 25-July 1, Munich, Germany. International Acetylene Association, 30 E. 42nd St., New York, N. Y.

American Society of Heating and Ventilating Engineers: Semi-annual meeting, July 4-6, Grand Hotel, Mackinac Island, Mich. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

American Society of Mechanical Engineers: Semi-annual meeting, week of July 10, San Francisco, Calif. Headquarters office, 29 W. 39th St., New York, N. Y.

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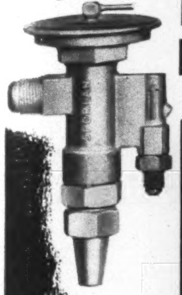

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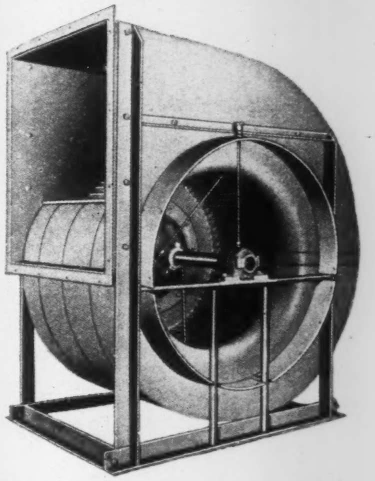

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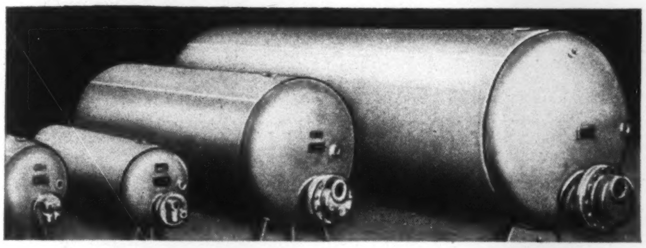

The two Patterson Everdur Heaters at the left were installed in U. S. Post Offices at Burlington, N. J., Mt. Vernon, N. Y., and the U. S. Parcel Post Bldg., Detroit, Mich. The one at the right was installed in the Myron Stratton Home, Colorado Springs, Colorado.

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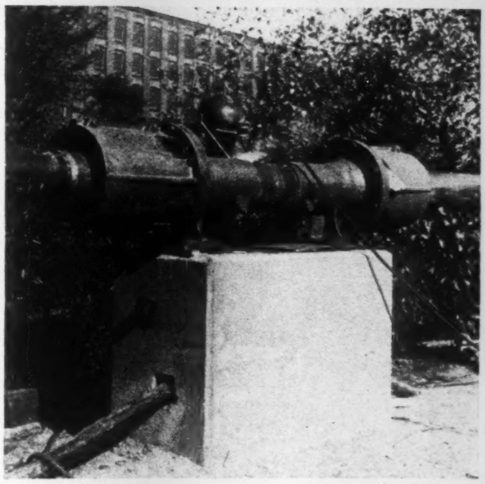

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A completely guided joint—inside and out. Slip cannot pull out of body. No metal to metal contact between body and polished slip surface. Available in semi-steel, cast steel, or wrought steel for high or low pressures in single or double joints with or without anchor base and service connections.

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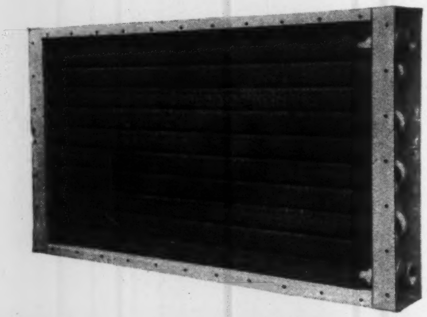

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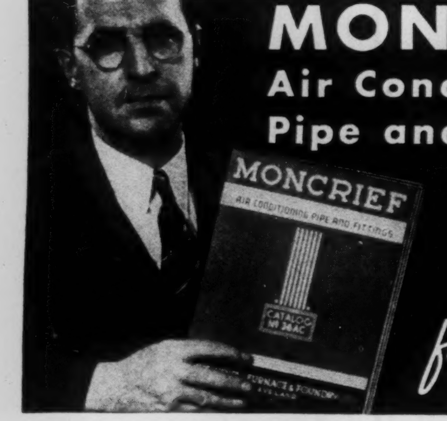
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Book Reviews

Fan Engineering

["Fan Engineering," edited by Richard D. Madison. 4th ed. 1938. 739 pp., 4x6 in., printed on thintex paper, gold edges, black fabricoid binding. Published by Buffalo Forge Co., 171 Mortimer St., Buffalo, N. Y. Price, $4.00.]

The new edition of this well known handbook on air, its movement and distribution in air conditioning, combustion, conveying and other applications employing fans, has been extensively rewritten and reset. It has over 120 more pages than the previous edition and all sections except those dealing with basic laws have been extensively revised. The new data are contained principally under the following headings: Properties of air; heat and humidity; flow of fluids in general, in ducts, and in the fan; air conditioning and sound control; combustion; mechanical draft; drying; dust elimination; and exhausting and conveying.

New sections are devoted to power equipment, fan details, typical problems and selection of apparatus. Condensed information on dimensions and performance of typical fans and air conditioning equipment is included. Many of the tables have been revised on the basis of the latest information available and the book is elaborately indexed. A new feature is the inclusion of a quick reference index to tables and curves which are frequently used.

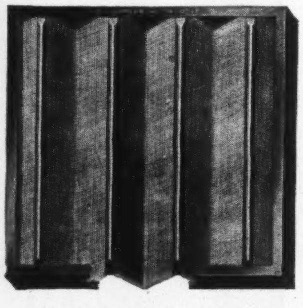
The first edition of this book, which appeared in 1914, was edited by W. H. Carrier.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 134. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 3076. AMMONIA LEAK DETECTORS: Pennsylvania Salt Mfg. Co., Dept. 21, 1335 Chestnut St., Philadelphia, Pa. Card containing six detector wicks for discovering the source of an ammonia leak, available upon request to users of ammonia.

No. 3077. BOILER WATER LEVEL CONTROL: McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill. 22 p. catalog on boiler water level control including water feeders, low water cut-offs, combined water feeders and low water cut-



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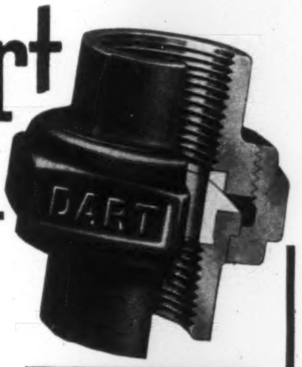

gives the service of several ordinary unions

Dart Unions cost less in service. And for one simple reason: They have extra long service-life. They make up to tight joints the first time installed, and **for many times to come** . . . Darts give you this extra service—and savings—because of their ground, spherical seating surfaces—make tight seals under repeated use . . . Air-refined malleable iron bodies and nuts—and bronze seats make Darts physically fit to withstand pipe strains, wrench abuse, and corrosion . . . Get Dart service, and savings, on your pipe lines. Send for one to try—at our expense—today.

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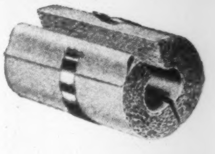

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Note—below—the smallness of air spaces in Careycel, as compared with ordinary aircell covering. The Carey process of "cellizing" the asbestos sheets makes possible the higher efficiency of Careycel.

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CAREYCEL—the patented insulation for low pressure steam and hot-water heating systems (for temperatures up to 300°) — assures utmost satisfaction for the customer . . . better profits for the heating contractor.

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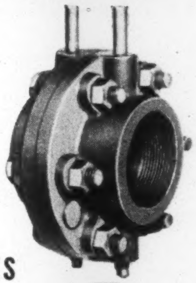

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Thin plate orifices, correctly engineered to measure your flows, are made of Monel Metal or Stainless Steel, with number and size stamped on the ear for easy identification.

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The PORTABLE, table-mounting style shown, is ideal for checking flow differentials at EACH orifice in the system. Also available for panel or wall mounting. WRITE FOR BULLETIN B.

Model A-203

THE MERIAM CO.
Instruments for Indicating Pressure or Flow of Liquids and Gases
CLEVELAND • OHIO

MEETING SPECIAL REQUIREMENTS
BELLOWS WITH SILVER-SOLDERED JOINTS FOR HIGH-TEMPERATURE WORK

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HYDRON Metallic Bellows are used as control elements in temperature-and-pressure-control devices, and for liquid or gas seals of compressors and pumps. We are specialists in the design and production of complete thermostatic and pressure units for temperature and pressure controls. We are, therefore, prepared to extend the fullest co-operation to engineering departments of control manufacturers in the solution of design and engineering problems.

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BOSTON CHICAGO DETROIT LOS ANGELES
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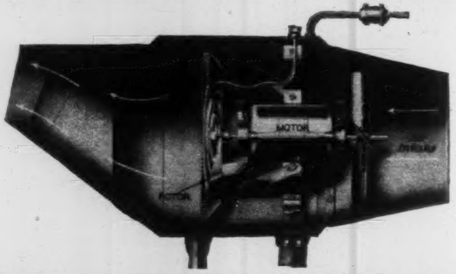

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The HOLTZER-CABOT
ELECTRIC COMPANY
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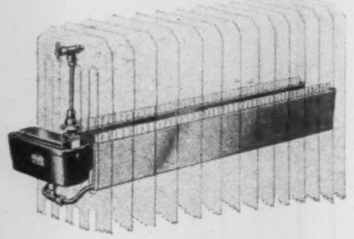
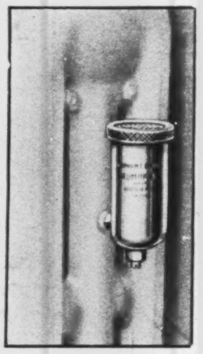
CHICAGO · NEW YORK · PHILADELPHIA ·

These New Humidifiers Bring You NEW PROFITS



No. 30 Ol' Faithful Automatic Humidifier

For Hot Water, Vapor or Vacuum Steam Radiators. Two copper evaporators with patented wicks fit in between radiator sections, and they are supplied from an enameled reservoir equipped with automatic float valve. Water supply may be taken from radiator or nearest water line.



No. V-95 Auto-Vent Humidifier

For Vapor or Vacuum Steam Radiators. Automatically vents air from radiator and humidifies. The bronze check in valve seat prevents air from re-entering radiator while vacuum is maintained within the heating plant. Easily adjusted by set screw at bottom of valve.

Send for Free Catalog H-3

MAID-O'-MIST, Inc.
180 N. Wacker Drive, Chicago, Ill.

offs, liquid level controls and automatic protective devices. Also, a condensed catalog and price list of this manufacturer's products.

No. 3078. CONTROL APPARATUS: Schaefer Bros. Co., 1059 W. 11th St., Chicago, Ill. Looseleaf bulletin file on control apparatus, rheostats, and resistors, with the equipment described in detail and including list prices.

No. 3079. CONTROL VALVES: Bristol Co., Platts Bridge, Waterbury, Conn. 20 p. bulletin (514) on air operated "Synchro-Valves" for automatic control of pressure, flow, liquid level, temperature, and humidity. Principles of design are given and directions for ordering or specifying are included.

No. 3080. CONTROLLERS: Bristol Co., Platts Bridge, Waterbury, Conn. Bulletin (523) on single cam cycle controller describing features and functions and the three way leakless pilot valves with which these controllers are equipped.

No. 3081. COUPLINGS: Pittsburgh Equitable Meter Co., 400 N. Lexington Ave., Pittsburgh, Pa. 12 p. bulletin (M-700) on "Raybould" fittings and couplings for steel pipe, describing and illustrating features and giving specifications and list prices. These couplings can be used on plain end pipe in sizes from ½ to 12¾ in. and compensate for slight deflections in alignment or length.

No. 3082. DIAL INDICATING THERMOMETERS: C. J. Tagliabue Mfg. Co., 540 Park Ave., Brooklyn, N. Y. 16 p. catalog (1170) on "Tag" dial indicating thermometers illustrating and describing them in detail and showing accessory equipment.

No. 3083. FLAME CONTROL: Wheelco Instruments Co., 1933 S. Halsted St., Chicago, Ill. 4 p. bulletin (A-1105) on "Photo-Head" for affording instantaneous protection against flame failure for fuels other than gas burning with luminous flames. It is a photo-electric device which operates to shut down fuel supply and prevent entry of unburned fuel into the combustion unit.

No. 3084. FLEXIBLE TUBING: Resistoflex Corp., 370 Lexington Ave., New York, N. Y. Folder describing flexible tubing which is impervious to oils and organic solvents and is vibration proof. The material is used also for gaskets, sheet material, and dipped goods.

No. 3085. INSULATION MATERIALS: Grant Wilson, Inc., 4115 W. Taylor St., Chicago, Ill. 6 p. wholesalers' cost sheet and catalog of insulation materials for heating, air conditioning, and plumbing.

No. 3086. MOTOR STARTERS: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 8 p. bulletin (B. 2131) on combination line starters combining "De-ion" line starter and "Nofuze De-ion" circuit breaker. Low installation and operating cost, compactness and safety of this equipment are stressed.

No. 3087. MOTORS: Diehl Mfg. Co., Trumbull St., Elizabeth, N. J. 26 p. catalog and price list (39) on electric motors, generators and ventilating equipment including application data, dimension tables, ratings, etc.

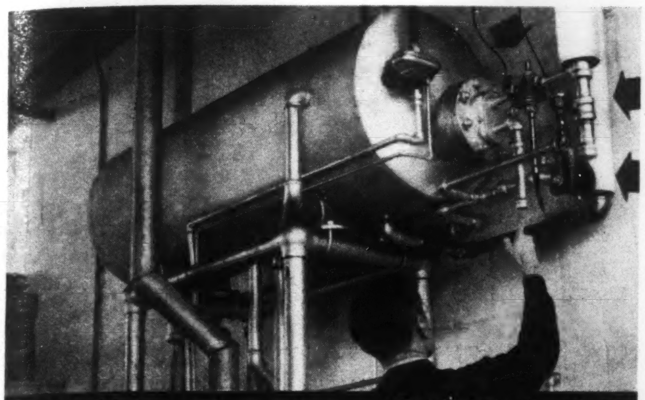
No. 3088. MOTORS: Louis Allis Co., 427 E. Stewart St., Milwaukee, Wis. 12 p. bulletin (508E) on new explosion proof motors, illustrating details of construction and describing features.

No. 3089. NICKEL: International Nickel Co., Inc., 67 Wall St., New York, N. Y. 20 p. bulletin (T-15) on the engineering properties of nickel, including data on composition, physical constants, mechanical properties, corrosion resistance, working instructions, mill products, castings, and special nickel alloys.

No. 3090. PIPE AND BOLT MACHINES: Beaver Pipe Tools, Inc., Keeney Ave., Warren, Ohio. 4 p. bulletin (C) describing a compact power unit for converting hand tools into a portable pipe and bolt machine.

No. 3091. REGISTERS: Independent Register Co., 3747 E. 93rd St., Cleveland, Ohio. 4 p. folder (S-36-39) on wrought steel registers and intakes illustrating and describing various styles and giving list prices.

No. 3092. SQUARING SHEARS: Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. 16 p.



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—That's why we standardize on Sarco for the control of our hot water temperatures."

Sarco Temperature Regulators pay for themselves quickly by preventing wasteful over-heating, by protecting the quality of heat processed goods—by saving steam, labor and overhead.

The illustration above shows a Sarco Temperature Regulator, a Sarco Float Trap and a Sarco Thermostatic Drip Trap on Water Heater.

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SARCO THERMOSTATIC, FLOAT AND BUCKET TRAPS, REGULATORS AND HEATING SPECIALTIES

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RANDALL PILLOW BLOCKS

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Used by 75% of the field

The faultless operation and dependability of Randall Pillow Blocks make them the most desirable to the air conditioning industry. Since their introduction, more than a half million have been used. Their proved ability to stand up under all conditions of use in the field is the reason for their great popularity.

Use Randalls and end your pillow block troubles for good.

Write for 1939 catalog describing in detail our complete line.

Randall D.R.O.R. (Double Reservoir Oil Return) Pillow Block with large oil reservoir, shown with special large oiler.

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Dept. 310 609 W. Lake St., Chicago, Ill.

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Easy to Clean and Inspect
AIR CONDITIONING COILS

Bulletin 282-A fully describes these qualified coils. Plugs are non-ferrous, corrosive resisting, located at both ends of each run of tubes permitting easy removal, without special tools, for individual coil cleaning or inspection. No gaskets. A very flexible line with a wide range of sizes and capacities for any application. Single or double serpentine construction.

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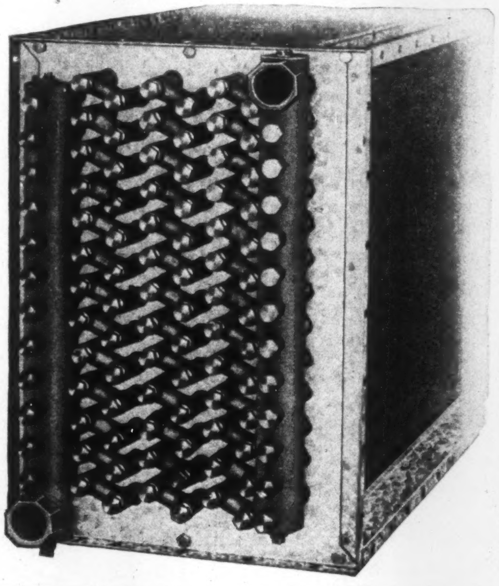

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Fortify your Equipment *with* PALCO WOOL .255 B.t.u. EFFICIENCY

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NOZZLES

YARWAY INVOLUTE

Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-615.

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MERMAID AND ANDERSON STS.
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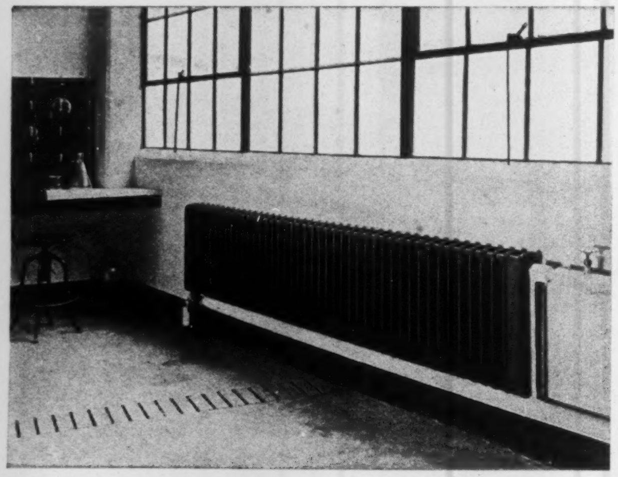

Perkins Radiator operating on high pressure steam in the Pittsburgh laboratory of the American Cyanamid & Chemical Corporation.

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Operate on all pressures up to 150 lb.

Combine the most advantageous features of convector—radiator—and unit heater. Approximate unit heater performance in air movement, while delivering a desirable proportion of radiant heat. At elevated steam pressures the surface temperatures are lower than those of the conventional exposed types operating on low-pressure steam.

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Heating, Piping and Air Conditioning,
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Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1625	1626	1627	1628	1629	1630	1631
1632	1633	1634	1635	1636	1637	1638
1639						
3076	3077	3078	3079	3080	3081	3082
3083	3084	3085	3086	3087	3088	3089
3090	3091	3092	3093	3094	3095	3096
3097	3098	3099	3100			

Name.. Title..........
Company ....
Address ....
City.. State..........

bulletin (BL) on power squaring shears with capacities up to 10 gage. Features include massive box section bed which contributes to strength and rigidity and maintains accuracy of knife setting, and a new self-measuring ball bearing parallel back gage.

No. 3093. STOKERS: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 20 p. booklet (B. 2170) describing single and multiple retort stokers for bituminous coal. Included are multiple retort stokers for boilers from 300 rated boiler horsepower up, and single retort stokers for boilers from 100 to 500 rated boiler horsepower.

No. 3094. TEXTILE MILL CONDITIONING: Parks-Cramer Co., 970 Main St., Fitchburg, Mass. Issue of "Parks' Parables" dated February, 1939, on certified climate in textile mills, covering cotton picking, carding and roving. "Turbo" humidifiers and dustless card strippers are featured.

No. 3095. THERMOMETER CONTROLLERS: Wheelco Instruments Co., 1933 S. Halsted St., Chicago, Ill. 2 p. bulletin (4201) on industrial indicating control thermometers on which any scale desired up to 1000 F may be had. It makes use of a bulb and capillary to actuate a bourdon tube assembly and the controller operates on the "no contact" electronic principle.

No. 3096. UNIT HEATERS: Young Radiator Co., 709 Mead St., Racine, Wis. Leaflet (Form 2538) on controlled heat with unit heaters, describing briefly features of the manufacturer's "Streamaire" units.

No. 3097. VALVES: Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa. 32 p. bulletin (8-A) on valves for various purposes including automatic shut-off valves, change-over valves, check valves, indicator valves and others. Each type is carefully described and illustrated and features are discussed.

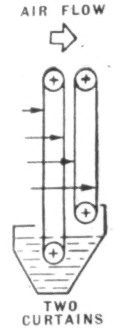
No. 3098. WATER LEVEL CONTROLS: Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa. 8 p. bulletin (18-Z) on water level "Televisors" for boilers, closed tanks and open tanks, and water level controls. Applications are diagrammed.

No. 3099. WELDING HOSE: Hewitt Rubber Corp., 245 Kensington Ave., Buffalo, N. Y. Folder describing "Twin-weld" welding hose consisting of two lines of flexible cord reinforced welding hose molded into a single unit that will not kink or writhe, or twist under high pressure. Available in any desired cut length or in continuous lengths up to 500 ft.

No. 3100. WELDING WROUGHT IRON: A. M. Byers Co., Clark Bldg., Pittsburgh, Pa. Revised edition of 16 p. service bulletin on the welding of wrought iron, discussing processes and procedures, physical properties of welds, and including a great deal of test data and practical information which has been obtained from the field.

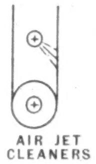
HERE IS A BETTER AUTOMATIC AIR FILTER

AND HERE'S WHY



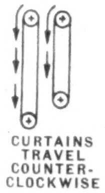
One only of the *two* endless revolving filter curtains enters the oil bath. This curtain traps most of the dust particles. The second curtain, moistened slightly by evaporated oil, traps any extra-fine particles which may pass the first curtain. Only the Staynew filter has the two-curtain feature.

NO OIL ENTRAINMENT • NO CLOGGING • HIGH EFFICIENCY



This new Staynew filter possesses another exclusive feature which absolutely prevents oil entrainment and clogging and increases filtering efficiency greatly. This is the double series of compressed air jets which remove all excess oil from the first curtain and all oil-moistened dust from the second curtain.

DIRECTION OF CURTAIN TRAVEL IMPORTANT



Both curtains travel in a counter-clockwise direction. This is highly important in the case of the first curtain, for it means that the outlet side is most free of dust, having been cleaned by the oil bath and the air jets.

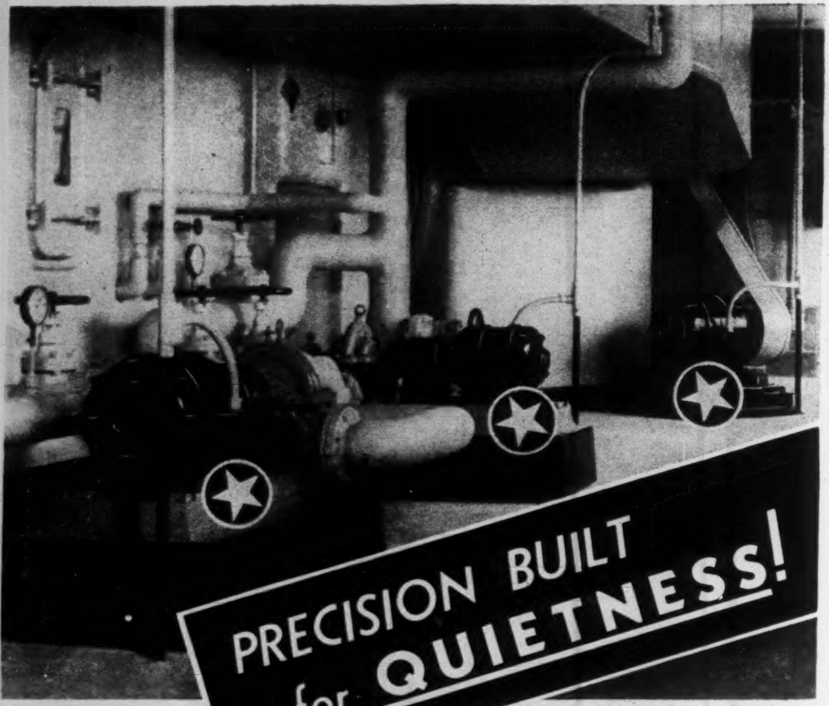
Available in sizes to accommodate from the smallest to the largest requirements.

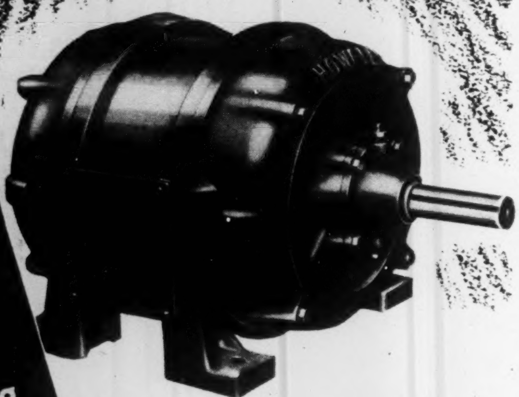
WRITE FOR BULLETIN 120

for complete data.

STAYNEW FILTER CORP.
"Air Filter Headquarters"
9 LEIGHTON AVE., ROCHESTER, NEW YORK

PROTECTOMOTOR
REG. U.S. PAT. OFF.
99 9/10 Per Cent EFFICIENT
AIR FILTERS




COMPLETE LINE OF MOTORS TO MEET Any Type of Air Conditioning Requirement

You Can Stake Your Reputation on HOWELL Performance!

Engineers and contractors—you men who plan, install and operate air conditioning systems—can profit by specifying and using HOWELL Motors.

For HOWELL Motors give you superior insulation, insuring LONGER mechanical life . . . dynamically balanced rotors . . . ground stators, affording uniform air gap . . . heavier frames, heavier end plates . . . every motor vibrometer tested.

And this more rugged construction produces QUIETNESS—strength, rigidity, and exacting balance tests eliminating vibration.

No matter how tough the job—how "special" the application—you can stake your reputation on HOWELL Motors, which are now driving a goodly share of all conditioning equipment in operation.

Bulletin 1126D covers our complete line—write for a copy today!

HOWELL RED BAND MOTORS Make Good on Hard Jobs

★ *Illustration at top shows HOWELL Motors driving air washer pumps and main supply fan in new office building air conditioning system of large pharmaceutical manufacturer. This company INSISTS on HOWELL, as the result of over 20 years' experience with hundreds of HOWELL Motors in its various plants.*

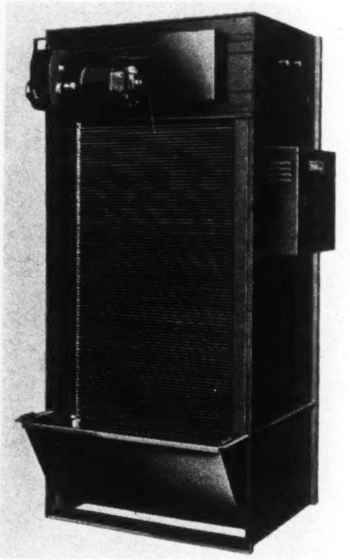
HOWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN
Representatives In All Principal Cities

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 130. Add the new products and companies listed here to your Directory Section which you received in your January, 1939, HEATING, PIPING AND AIR CONDITIONING and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Combined Electrical and Automatic Air Filter

No. 1640*—The "Electro-Matic" air filter is a new development in which electrical precipitation is combined with automatic air filtration to obtain the advantages of both these methods of cleaning air. The combination not only assures uniformly high cleaning efficiency over practically the entire range of particle sizes, but offers other advantages which make the new unit an outstanding advancement, according to the manufacturer.



The front curtain of the filter acts as a pre-cleaner to remove the heavier dust particles and any bugs, butterflies, or scraps of material that might short circuit the ionizer or the collector plates in the rear curtain. Fine dust and smoke particles which escape the front curtain then pass through the ionizing unit in the center of the filter where they receive a definite electrical charge. Upon entering the electrostatic field of the rear curtain these ionized dust particles are attracted to the charged plates where they are held in the oil film on the plates until removed in the oil bath.

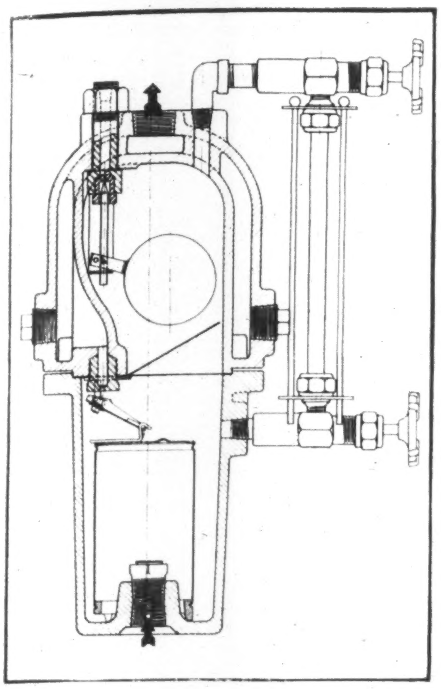
The filter curtain is of a new design to provide the necessary electrical insulation of the plates and a means for charging or grounding alternate plates in certain sections of the curtain. It meets the additional requirement of reverse direction of rotation so that the accumulation of dust and dirt on the front curtain is carried directly down into the reservoir where it is removed by the cleansing action of the oil bath, leaving the rear curtain clean and freshly oiled at all times.

The filter is made in standard sections of varying heights from 5 up to 13 ft. The power pack which furnishes the current for the ionizer and collector plates is mounted on the filter casing and all internal electrical connections are made at the factory.—American Air Filter Co., Inc., 107 Central Ave., Louisville, Ky.

Refrigerant Gas Purger

No. 1641*—Designed to operate as a purger or as a combination expansion valve and purger, this unit removes air and incondensable gases from refrigerating systems using any common refrigerant except CO_2.

It consists of an inverted bucket and valve mechanism in the lower half and a ball float and needle valve in the upper jacketed dome. It is connected to the receiver so it can take gas from the top of the receiver and enough liquid from the bottom to keep the cooling jacket filled.



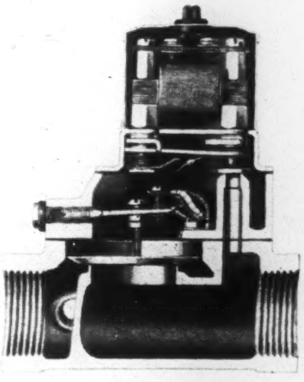
Refrigerant gas and a small amount of liquid refrigerant enter the purger at the bottom. The inverted bucket mechanism allows the liquid to enter the purger jacket at suction pressure, which causes the refrigerant to boil and chill the liquid within the purger dome. Gas passes through the vent in the inverted bucket and rises through the chilled liquid. The refrigerant gas condenses while the air present collects at the top, depressing the liquid level until the ball float sinks and opens the air relief valve. When the air has been purged, all gas passing through the bucket vent will be condensed and the air relief valve hence will remain closed.

When used as a combination expansion valve and purger, the unit is connected directly to the bottom of the condenser. It takes the liquid refrigerant as it forms and discharges it into the evaporator. This flow brings any air present into the purger, where it is collected and discharged from the upper chamber.—Armstrong Machine Works, 874 Maple St., Three Rivers, Mich.

Slow Acting Gas Valves

No. 1642—New slow opening gas valves recently announced provide a soft ignition at low flame followed by a gradual opening to full flame. They incorporate a snap primary flow of adjustable volume, a hesitation period, allowing time for uniform draft to be established, followed by slow opening to full capacity. The closing cycle is snap acting.

These valves are made in two sizes, ¾ and 1 in. pipe tap, and operate on 20 volts. —Julien P. Friez & Sons, 4 N. Central Ave., Baltimore, Md.



Wet and Dry Bulb Indicating Hygrometer

No. 1643—A new indicating hygrometer of the wet and dry bulb type combines accuracy and legibility with complete accessibility for installation and routine servicing, according to the manufacturer. By loosening two thumb screws the complete assembly swings out on a triple hinged bracket.

In order to increase efficiency, the wet and dry bulbs are staggered and the instrument therefore can be used in either horizontal or vertical ducts without the bulbs being on the same plane. The flat tube scales are mounted horizontally to

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Air Conditioning and Refrigeration Equipment

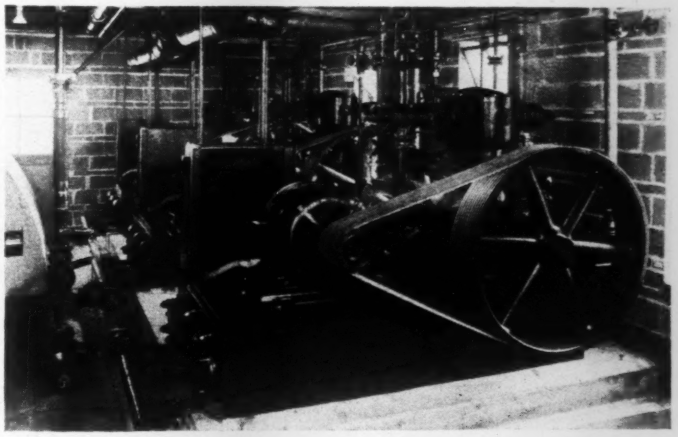
SPEAKS FOR ITSELF . .

in terms of

LOW POWER PER TON
HIGH EFFICIENCY
LONG SERVICE-SATISFACTION

Air Conditioning Engineers and Users are "cashing in" handsomely on the rich experience brought them by Vilter Engineers. Pioneers in modern Air Conditioning, Vilter Engineers have planned, designed and helped to install Equipment that is daily proving its superiority in all the points you look for in a successful and profitable job.

Satisfaction on any Air Conditioning Installation depends upon smooth-running cooperation of every piece of equipment. When all the units are designed and built by Vilter, you can depend upon 100% efficiency on every job—customer-satisfaction based on low power costs per ton and freedom from annoying and costly service calls.



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Air Conditioning Capacity 70 Tons

Superior Since 1867
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Air Conditioning Refrigeration . . .

THE VILTER MFG. COMPANY
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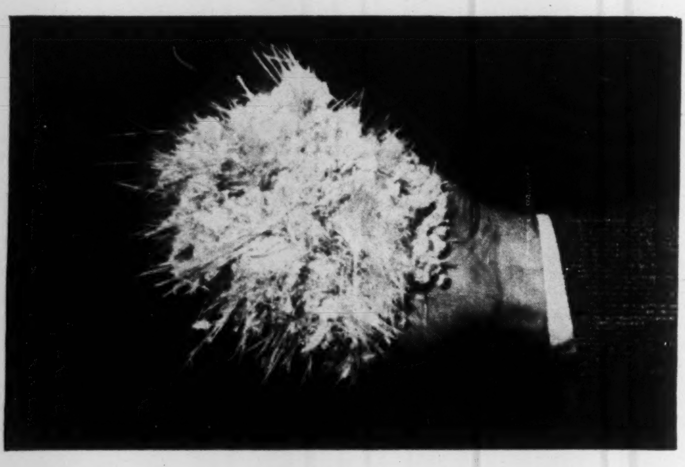


A Word About **DRY-PAC** for *your* Protection

The key to efficiency in an underground steam conduit system is largely found in the type of *insulation* used. Dry-paC is *not* a general term for any ordinary or even a loose asbestos filler—but an exclusive registered trade mark applied only to a Ric-wiL product manufactured entirely in our own factory and fully guaranteed by us.

Dry-paC is NOT cheap commercial asbestos—it is a proven combination, 85% high grade long-fibre asbestos combined with 15% carefully selected, clean sponge particles, all processed to make the mass positively water repellent. It is manufactured under strict laboratory control at all times and guaranteed to meet definite specifications which we will gladly furnish on request. Secure and use these specifications on your next installation.

Accept no substitute for Dry-paC—there really *is* none.

REMEMBER—a Ric-wiL system, with genuine Dry-paC Insulation, keeps your steam lines permanently tight, dry, and at least 90% efficient. Descriptive bulletin and test data sent promptly on request.

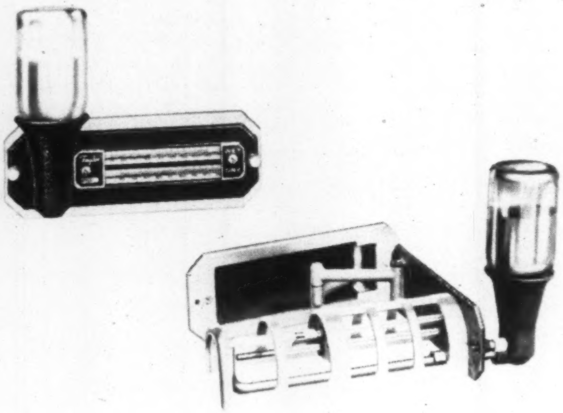
The Ric-wiL Co., Union Trust Bldg., Cleveland, Ohio
New York Chicago
Agents in principal cities

Dry-paC is not made to meet a price—specify it fully as described above and obtain our "Certificate of Warranty" furnished with every order.

REGISTERED IN U. S. PATENT OFFICE
RIC-WIL
CONDUIT SYSTEMS FOR
UNDERGROUND STEAM PIPES

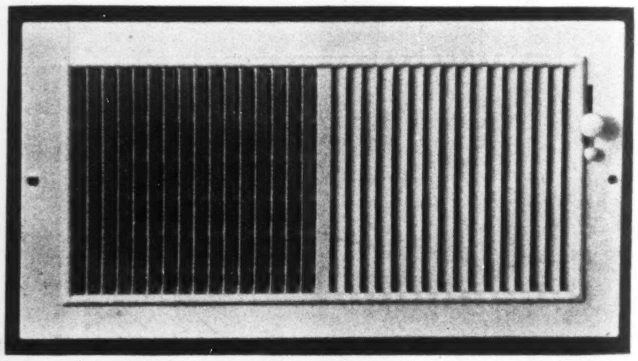
present a natural position for reading the mercury column and increase the angle of vision. The required opening in the duct for installation is 8x2¾ in.

Water is supplied the wick by filling the water bottle and inverting it in the bottle holder, which is designed to take a regular "stubby" beer bottle. Where a pressure or vacuum of more than ½ in. of water makes a bottle fed hygrometer impractical, a unit with a constant level reservoir is available. The space required for its installation is 4x8 in.—Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.



Air Conditioning Register

No. 1644—A new register for air conditioning work offers control of the air flow both vertically and horizontally. Thus the one register can be used throughout an entire installation, and in all locations, regardless of whether duct openings are at the baseboard, high on the wall, in one corner, or elsewhere, the maker states.



Adjustment is made after the register is installed and painted. Vertical control of the flow is secured through a series of movable shutters on the back of the register, which are connected to the knob on the upper right hand corner of the margin. A small button below the knob is a stop which controls the position of the shutters when open. Any angle of deflection may be secured from 15 deg upward to 30 deg downward. Horizontal control of the air flow is obtained by adjusting the vertical fins, and a special tool is provided for this.

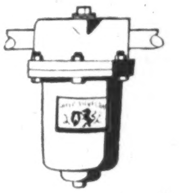
Improvements in construction include one-piece construction of fins and margin, designed to prevent breakage and eliminate unnecessary working parts.

The manufacturer has also announced a simplified control for dampers. Ease of installation has been provided by designing the control so that the tail bearing does not project beyond the edge of the damper. With this control, dampers may be readily installed without bending, it is stated, and both ends of the

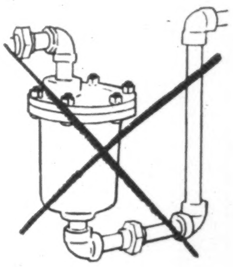
A STRAIGHT LINE IS THE SHORTEST DISTANCE BETWEEN 2 POINTS
You learned it then apply it now —

USE ANDERSON SUPER-SILVERTOPS

USE THIS



NOT THIS



Remember when you learned that "A straight line is the shortest distance between two points"? Why not apply that simple fact to steam trap piping? You can—Anderson Super-Silvertops and simplified piping make run-around puzzle piping unnecessary and old fashioned.

Anderson Super-Silvertops are long-life, trouble-free traps with extra, exclusive advantages engineered into the trap at no extra cost. These exclusive features are simplified piping, extra capacity, guided bucket and ease of inspection. Simplified piping permits elbow or straight-in-line connections with no extra fittings—a saving in labor and money. Extra capacity (106% greater than previous model) usually permits the use of a small Super-Silvertop instead of a larger, more expensive ordinary trap. Guided bucket increases bucket life, permits larger valve orifice. Ease of inspection (without disturbing pipe connections) cuts down cost of regular inspection.

Find out *more* about this engineered, modern, thoroughly proved trap—write today for complete story and prices.

THE V. D. ANDERSON CO.
1949 WEST 96th STREET • CLEVELAND, OHIO

Anderson **SUPER-SILVERTOP**

ACME PRODUCTS

REFRIGERATION AIR CONDITIONING

PIPE COILS — FINNED COILS — TUBING COILS — AMMONIA SHELL AND TUBE CONDENSERS — FREON CONDENSERS — EVAPORATIVE CONDENSERS—BRINE COOLERS—SHELL AND TUBE WATER COOLERS—DRY EXPANSION WATER COOLERS—UNIT COOLERS—BAUDELOT TYPE WATER COOLERS—ACCUMULATORS—HI-PEAK STORAGE WATER COOLERS—OIL SEPARATORS—LIQUID RECEIVERS—SPECIALTIES

For Complete Information—Engineering Service or Literature Write Main Office or

Factory Representatives:

Felix L. Alcus, 623 So. Peters St., New Orleans, La.
B. & W. Sales Co., 4374 Washington St., St. Louis, Mo.
Glen Moore Comstock, 604 Chamber of Com. Bldg., Pittsburgh, Pa.
Engineering Co. of Philadelphia, 2222 Arch St., Philadelphia, Pa.
Filbert & Couch, 90 West St., New York City.
Emanuel Feinberg, Penobscot Bldg., Detroit, Mich.
Fluid-Air Engineering Co., 311 W. Douglas St., Wichita, Kans.
F. H. Langsenkamp & Co., 229-237 E. South St., Indianapolis, Ind.
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W. E. Lloyd, 518 Cherry St., Winnetka, Ill.
O. K. McCullough, 1304 McGee St., Kansas City, Mo.
George F. Miller, 1625 K. St. N. W., Washington, D. C.
Pacific Factors, 703 Market St., San Francisco, Cal.
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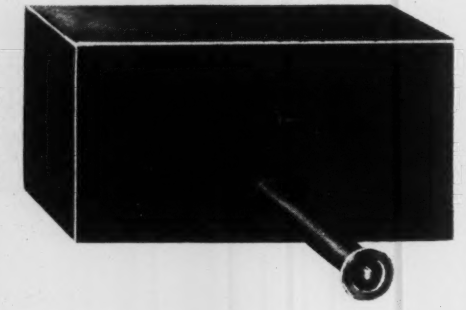
Zoned Controlled
HEATING



The AIROTHERM automatically holds the building at any predetermined temperature regardless of the varying conditions prevailing outside and is an important feature obtainable with Tallmadge Zoned Heating.

BETTER HEATING AT LESS COST
GIVES GREATER COMFORT
Improves Air Conditioning
WEBSTER TALLMADGE & CO.
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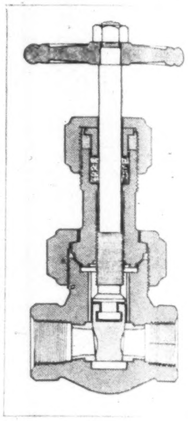
damper are tightly secured to the duct, thereby providing a double protection against vibration or rattling.—Air Contro Products, Inc., 100 E. Broadway, Muskegon, Mich.

Drop Forged Steel Gate Meter Valves

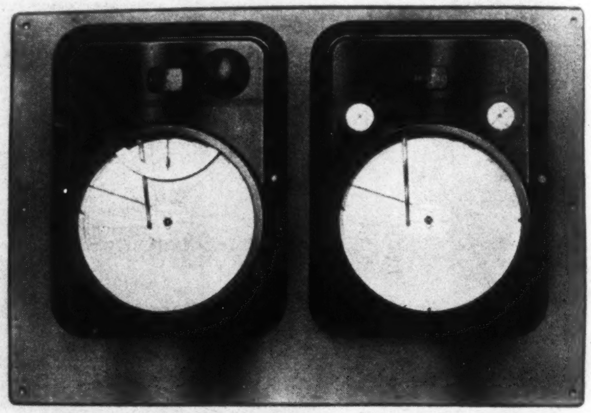


No. 1645—These new drop forged steel gate meter valves ar of the union bonnet, ground joint and inside screw stem type with removable rolled in seats and a loose, slotted gate. They are made in ¼, ⅜, ½, ¾ and 1 in. sizes of carbon steel with stainless steel trim or of all stainless steel, as required by the particular operating conditions.

Valves of this type are suitable for many applications where dependable regulation is required for meter and gage lines at high pressures and high temperatures. — Henry Vogt Machine Co., 10th and Ormsby Sts., Louisville, Ky.

Flow Ratio Control

No. 1646—The rate of flow of one fluid in definite ratio t the flow of a second fluid—automatically controlled—is accomplished by means of a new flow ratio controller. One of the features of the controller is an arrangement which permits changing the ratio by simply turning a knob on the outside of the case.



Thus, a 5:1 ratio between the flow of air and fuel gas, a 4:1 ratio between the flow of natural gas and artificial gas, a definite ratio between two different kinds of gases in a furnace, or a definite ratio between the lean oil and wet gas entering an absorber are some of its applications.

The controller consists of two instruments, a standard flow recorder and a standard flow recorder controller. The rate of flow is measured and recorded by one instrument, which also sets the control point on the second. The latter then records and controls the flow proportionately to the first, depending upon the ratio selected.—The Bristol Co., Platts Bridge, Waterbury, Conn.

Direct Current Welder

No. 1647—A new direct current arc welding motor generator set, with a rating of 150 amperes at 25 volts, and having a range of adjustments from 20 to 200 amperes at 25 volts, has been announced. Current control consists of a three point switch and a dial rheostat control for fine adjustment. It is stated by the maker that smoothness and precision of this adjustment makes it possible always to get the right current, and greatly

"Quiet, please..." ★

REDUCTION of the industrial noise factor has an ally in Webster-Nesbitt Unit Heaters. Their marked quietness is due to the way they are constructed as well as to proper care in their application to the job. Fans with especially wide, overlapping blades of gradual pitch are designed to eliminate eddy-current and blade-tip noises common to ordinary propeller fans. Proper spacing between fan and heating element provides a more uniform, quieter air flow; and rubber-isolated, slow-speed motors prevent the transmission of hum and vibration to unit casing and connected piping. Add to these *engineered application* by a trained Webster representative and you have an assurance of QUIET efficient operation that's bound to PLEASE.

SEND FOR CATALOG

Webster Nesbitt
UNIT HEATERS

For high-roof structures and large interiors where a long drive of air is required you can depend on Webster-Nesbitt Giant Heaters, blower-fan type. Send for new catalog.

Manufactured by JOHN J. NESBITT, INC., Holmesburg, Phila., Pa.
Distributed Exclusively in the U. S. A. by WARREN WEBSTER & COMPANY, Camden, N. J.
Address Nearest Webster Sales Office—Consult Your Telephone Directory

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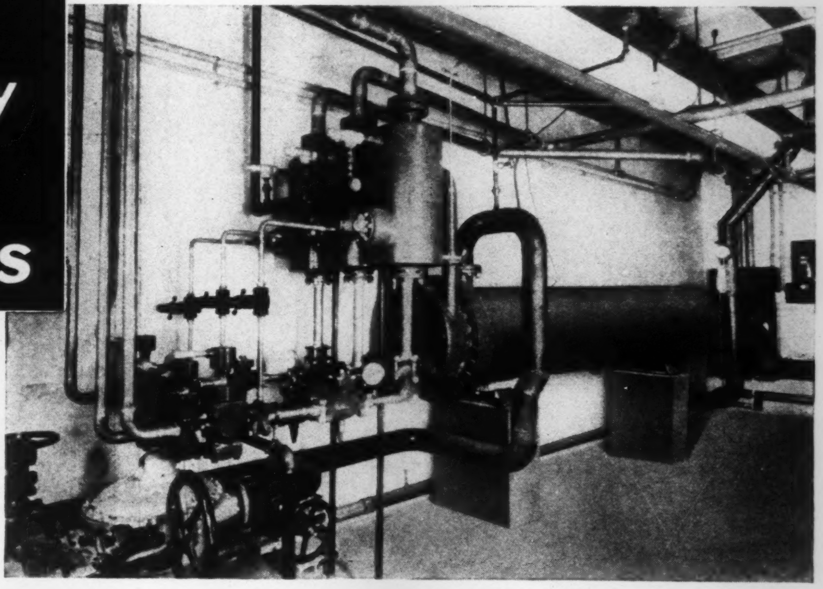
Patterson High Efficiency Freon Water Coolers

A higher rate of cooling efficiency is made possible by the use of recirculating controls. These controls cause liquid Freon to recirculate through the Patterson Cooler at high velocities, thus maintaining a wetted condition throughout the length of the tube, and reducing the resistance to the flow of heat from water to Freon. This more efficient heat transfer reduces the size of coolers required.

No thermo expansion valves are needed. Positive recirculation, positive oil return and positive superheat are assured.

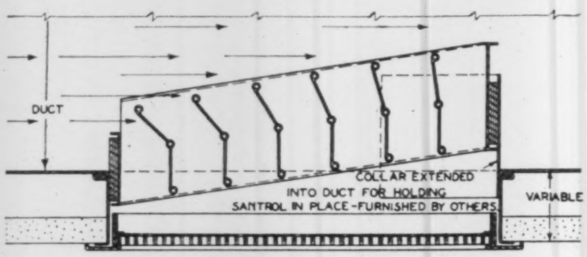


A 140 ton 3-circuit Patterson Water Cooler with recirculating control connected to three independent condensing units at the Royal Insurance Co., New York City. Designed and installed by Frigidaire for T. F. Hall, Heating & Ventilating Contractors.

Other important features are described in our Freon Cooler Catalog. Write for a copy.

The Patterson-Kelley Co., Inc,
107 Warren Street East Stroudsburg, Pa.

Positive Control!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COLLAR EXTENDED INTO DUCT FOR HOLDING SANTROL IN PLACE-FURNISHED BY OTHERS
VARIABLE

TUTTLE & BAILEY SANTROL

The Santrol is scientifically designed to combine positive control of air volume with even distribution of air flow over the entire surface of an outlet grille.

Simplicity of construction and installation are the two main features of the design.

The two series of deflecting blades, each individually adjustable, make the Santrol the most versatile unit of its kind. Each Santrol is provided with a heavy felt gasket which insures a tight leakproof fit and eliminates the necessity of attaching screws.

Have you your copy of air conditioning Catalog No. 39 at hand? If not, write today.

GRILLES
REGISTERS
AIR CONTROLS
Air Conditioning
39
TUTTLE & BAILEY
NEW

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&
BAILEY INC.
NEW BRITAIN, CONN.
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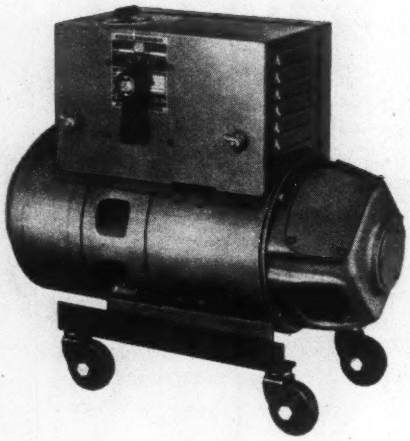


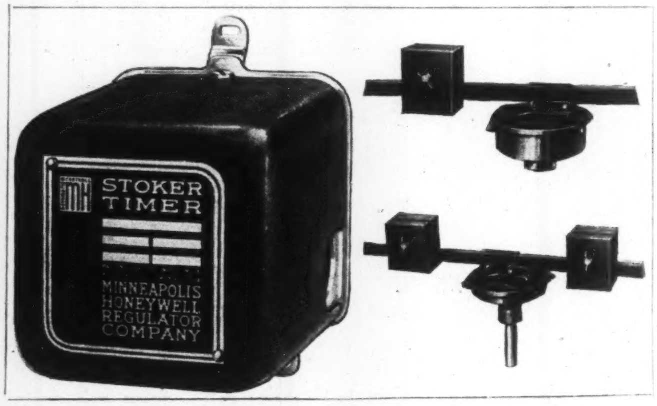
enhances the adaptability of the machine to all types of electrodes from bare to heavily coated. The set will use electrodes up to $\frac{3}{16}$ in. diameter.

The portable model, equipped with rubber tired casters, is 12 in. by $26\frac{5}{8}$ in., stands $23\frac{5}{8}$ in. high, weighs 338 lb. The stationary model, without casters, weighs 8 lb less. They are sturdily built, and attractively finished in yellow.

The manufacturer has also announced a new arc welder of 100 ampere rating at 30 volts for light sheet metal welding and other light work requiring low current and fine control. The new machine is of the alternating current, transformer type, and designed especially for use with heavily coated electrodes. A calibrated scale on the front of this welder indicates the adjustment throughout the range of the machine, which is from 25 to 150 amperes.—Wilson Welder and Metals Co., Inc., 60 E. 42nd St., New York, N. Y.

Stoker Timer and Boiler Regulators

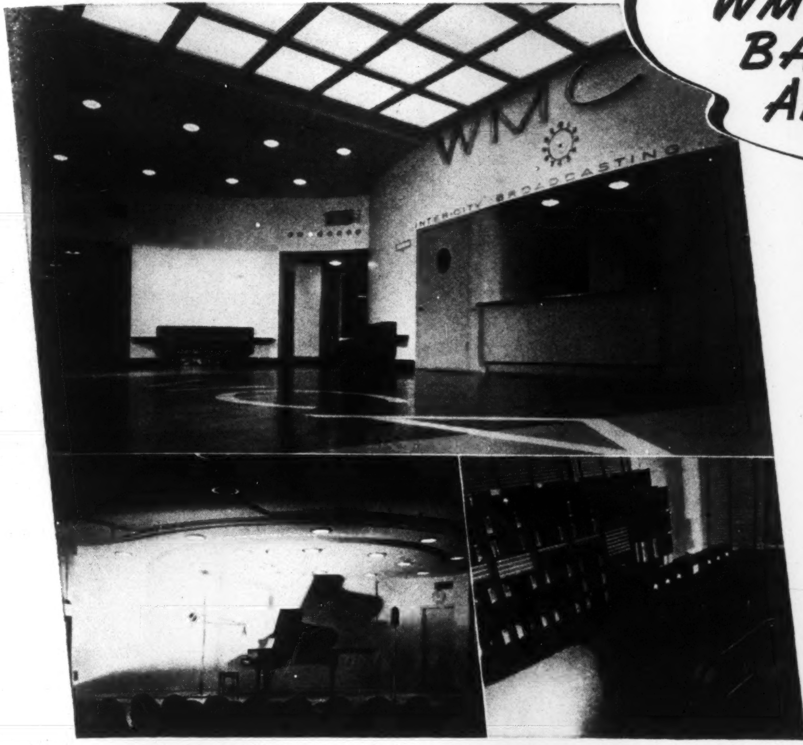
No. 1648—In the new "Stokertimer" illustrated, a synchronous motor rotates a cam which operates a mercury switch to provide the action for starting and stopping the stoker at desired intervals. Adjustments are provided to give suitable "on" periods at hourly or half-hourly intervals. The connection terminals are arranged to permit a separate load circuit if desired, i.e., a separate starter on a three phase line. This timer is a line voltage device and is used in connection with a line voltage controller which may be a thermostat, a pressure control or a relay.



The same manufacturer has also announced a new "Metaphram" steam boiler regulator and a new hot water boiler regulator. The first mentioned operates boiler draft and check dampers by an external lever which is governed by an increase or decrease of pressure within the diaphragms of the regulator. It is for application to small boilers requiring no more than 3 in. total movement of the dampers.

The hot water boiler regulator is self-contained and operates from water temperatures by insertion of a sensitive element in the boiler.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave. S., Minneapolis, Minn.

FLASH!
WMCA SELECTS BAKER SYSTEM AIR CONDITIONING



Leon Barmache, Designer; Rene Brugnoni, Architect.

AS the finishing touch to its streamlined new studios, Radio Station WMCA, New York City, selected BAKER System Air Conditioning. Automatic control of temperature and humidity plus freedom from disturbing noises, dust, and drafts provide perfect conditions for artists and audience alike.

BAKER'S complete range of sizes and long-standing reputation for high quality and economical efficiency of operation make it easy for BAKER engineers to meet the most exacting installation requirements. For full information, write

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ICE MACHINE CO., INC.
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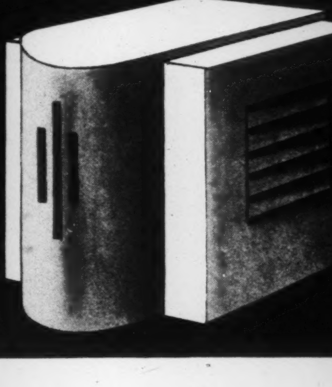
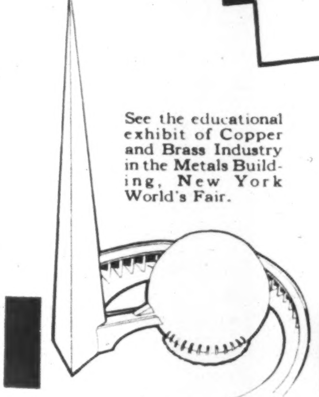
AUTHORITY ON MECHANICAL COOLING FOR OVER 30 YEARS

HUSSEY
COPPER HEADQUARTERS FOR THE AIR CONDITIONING INDUSTRY





See the educational exhibit of Copper and Brass Industry in the Metals Building, New York World's Fair.

Because of the complete facilities offered by Hussey from mine to warehouse, you will always find it both economical and convenient to centralize your copper requirements with this organization.

Backed by a nationwide sales and service organization with conveniently located, well stocked company warehouses in the larger industrial centers, you enjoy the advantages of controlled quality, low cost and undivided responsibility by specifying Hussey—a great name in copper for more than 90 years.

C. G. HUSSEY & COMPANY
(Division of Copper Range Co.)
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Copper **HUSSEY** *Brass*

"No Valves *Returned or Removed*"

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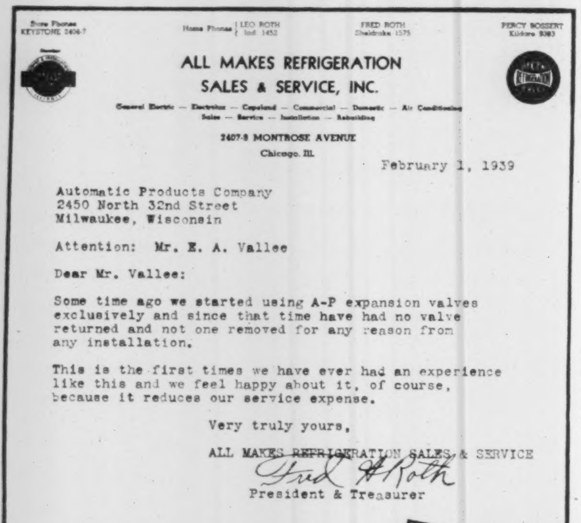

Store Phones
KEYSTONE 2404-7

Home Phones { LEO ROTH
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SALES & SERVICE, INC.
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2407-9 MONTROSE AVENUE
Chicago, Ill.

February 1, 1939

Automatic Products Company
2450 North 32nd Street
Milwaukee, Wisconsin

Attention: Mr. E. A. Vallee

Dear Mr. Vallee:

Some time ago we started using A-P expansion valves exclusively and since that time have had no valve returned and not one removed for any reason from any installation.

This is the first times we have ever had an experience like this and we feel happy about it, of course, because it reduces our service expense.

Very truly yours,

ALL MAKES REFRIGERATION SALES & SERVICE
Fred H Roth
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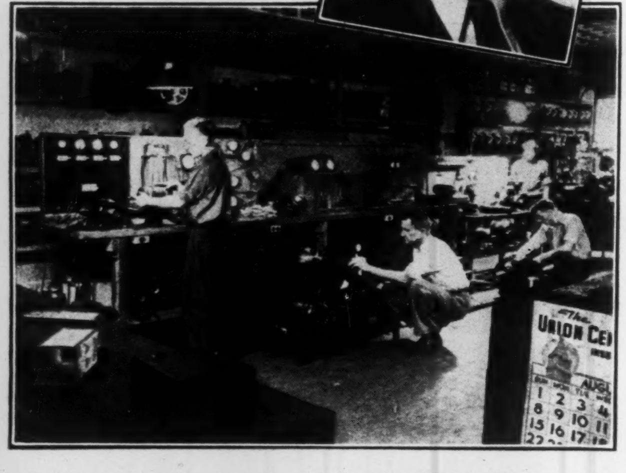
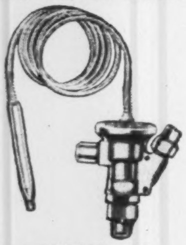
Mr. Fred H. Roth,
President and Treasurer

The busy repair and parts shop of "All Makes Refrigeration Sales & Services, Inc."



Refrigeration Engineers and Service Men! Treat yourself to the "unusual experience" of reduced service costs! Your Parts Jobber will tell you that the best way to do so is to switch to A-P Thermostatic Expansion Valves on all installations. For A-P Valves have long ago proved this Dependability on every type and size of Air Conditioning and Refrigeration.

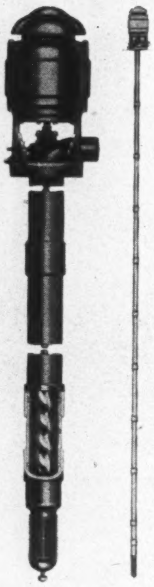
- **Refrigeration Parts Jobbers, Who Recognize Quality, Stock A-P Controls**



- Model No. 205 Thermostatic Expansion Valve

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN
Export Department, 100 Varick Street, New York City

DEPENDABLE
THE BYWORD FOR A-P CONTROLS



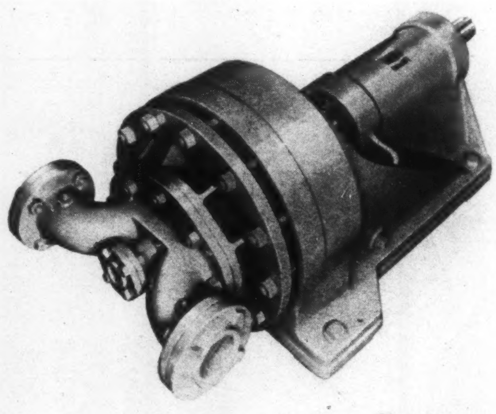
Deep Well Pump

No. 1649—"Hi-Lift" is the name of a new pump whose principal advantage (according to its maker) is its ability to obtain the maximum capacity from small drilled deep wells (as small as 3 in. diameter) with lifts ranging from 40 to 1000 ft and with small variation in capacity, or pressure, regardless of the height of lift. Other features include simplified design, slow speed operation of 1760 rpm, and resistance to abrasion. Capacities start at 5 gpm and pressures in excess of 500 lb are obtainable.

The design is an innovation, but is simple and practical and the principle is thoroughly tested and proved, the maker states.—Peerless Pump Div., Food Machinery Corp., 300 Walnut Rd., Massillon, Ohio.

Compressor and Pump for Corrosive Gases

No. 1650—A new compressor and vacuum pump has been designed especially for corrosive gases, for pressure or vacuum service in the process and chemical industries. The operating principle is the same as that of the maker's standard compressors and vacuum pumps, but new design permits use of corrosion resisting materials hitherto unavailable.



Construction is simple, with internal passages short and smooth flowing, the maker states. Sections are heavy and uniform in thickness, and there is only one stuffing box which is easily accessible. The single shaft sleeve is of new design and prevents possible leakage from the stuffing box entering the pump bearings. The maker also points out that gas pumping problems are in many instances handled easily by this unit because of the liquid ring which is part of the operating principle. A variety of liquids, such as water, solvent, alkaline solution, refrigerant and acid may be employed, depending upon the nature of the gas being handled.

Pressure limit of the chemical pump is 75 lb and higher pressures are available in staged designs. The vacuum limit is 27 in. of mercury with higher vacuums available in staged design.—Nash Engineering Co., South Norwalk, Conn.

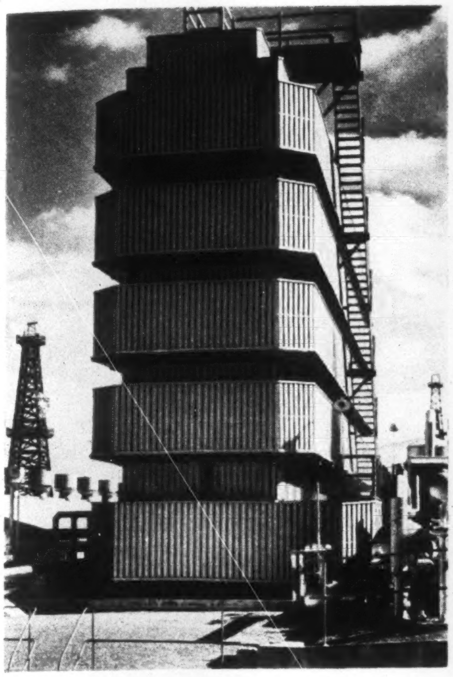
New Valves and Tankless Heaters

No. 1651—Three products recently brought out feature a number of improvements and are offered for application in the hot water heating field. They are the "B & G Thermo-Flo" valve, motorized valve, and "Super" tankless heater.

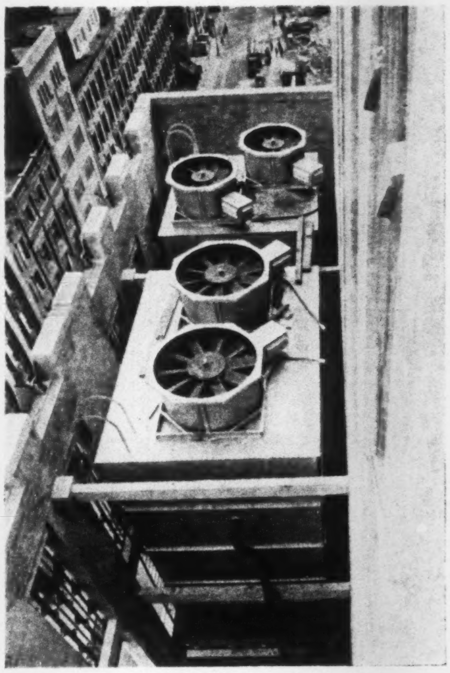
The motorized valve is for use with zoned systems and offers positive control of boiler water flow at small operating cost.

FLUOR

FOR YOUR COOLING REQUIREMENTS BE SURE WITH FLUOR



Aerator Type Atmospheric Cooling Towers



Forced and Induced Draft Cooling Towers

Get All the Valuable Benefits Offered By the Pioneer and Leader in Water Cooling Equipment Design, Engineering and Construction

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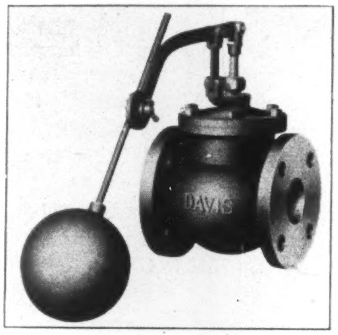


No. 60 FLOAT VALVE— (*Above*) A tight closing, non-sticking valve for make-up lines on open tanks. Handles hot or cold water without hunting or waterhammer. Renewable disc—no internal packing. ½″ to 12″ in globe or angle pattern.

CONTROLS *for Liquid Level, Flow and Make-Up*

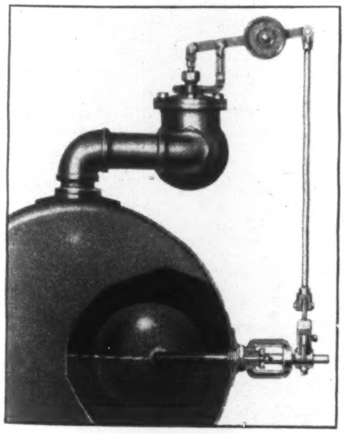
CONTROL of liquid level, flow, or make-up is a basic requirement in countless heating and air-conditioning jobs. As a rule, it pays to make the control as simple and direct as possible—first cost is lower and maintenance is simpler.

Unfortunately, the development of more advanced types of heating and air-conditioning systems has had a tendency to encourage more complicated control equipment.

It is for this reason that we call your attention to the units shown here and suggest that they and other standard Davis units offer opportunities to reduce installation costs and even improve dependability.

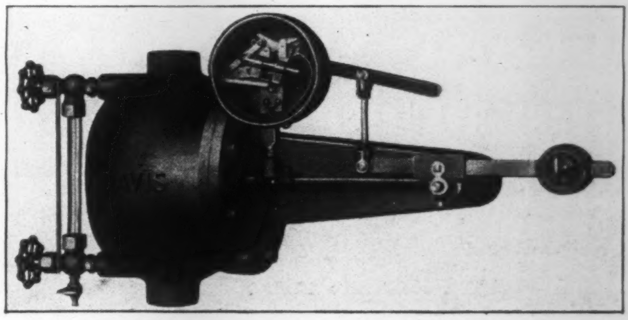
We will be glad to send you our complete catalog and to make recommendations on equipment suitable for your jobs. Write.

DAVIS REGULATOR CO.
2546 S. WASHTENAW AVE., CHICAGO, ILL.

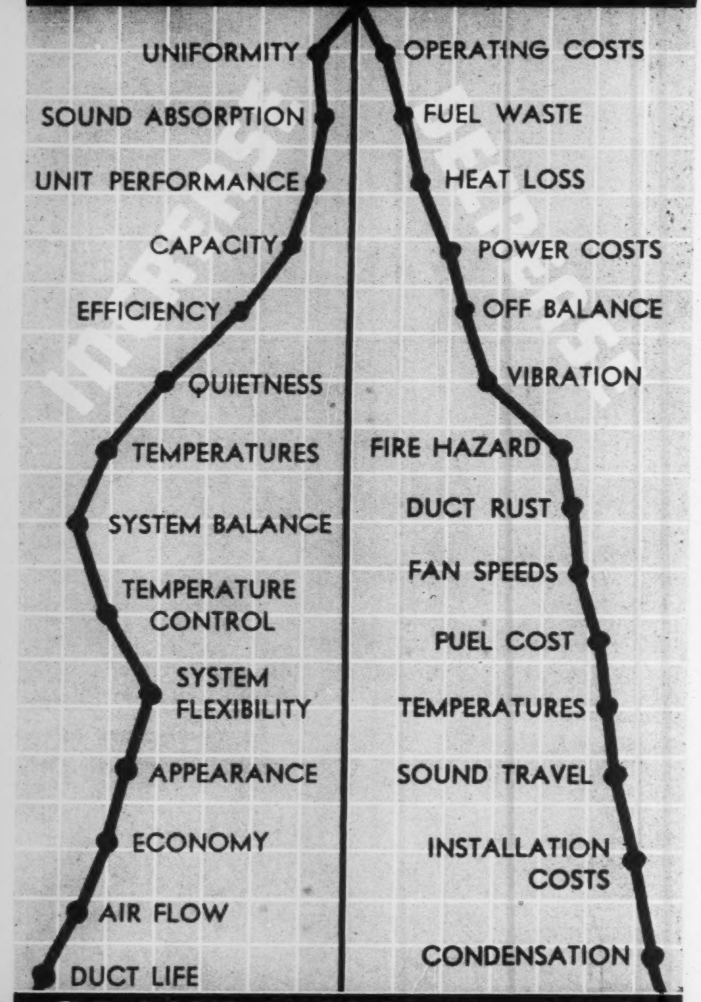


No. 170 FLOAT & VALVE— (*Left*) A complete unit for controlling make-up to closed tank. Float assembly screws into side of tank. Standard units for pressures up to 125 lbs. and in valve sizes from ¾″ to 6″.

No. 164 FLOAT BOX— (*Right*) For external mounting on closed tanks. Operates mercury tube, snap, or explosion-proof switch for controlling pump motor, solenoid valve, motor operated valve, or alarm, or any combination of these units.



INSULATE EVERY
DUCT
with Asbestos Protected
DUX-SULATION
. . . FOR A BALANCED AND
CONTROLLED OPERATION OF
AIR CONDITIONING SYSTEMS



GRANT WILSON, INC.
4101 West Taylor Street CHICAGO
PLANT RUBBER & ASBESTOS WORKS
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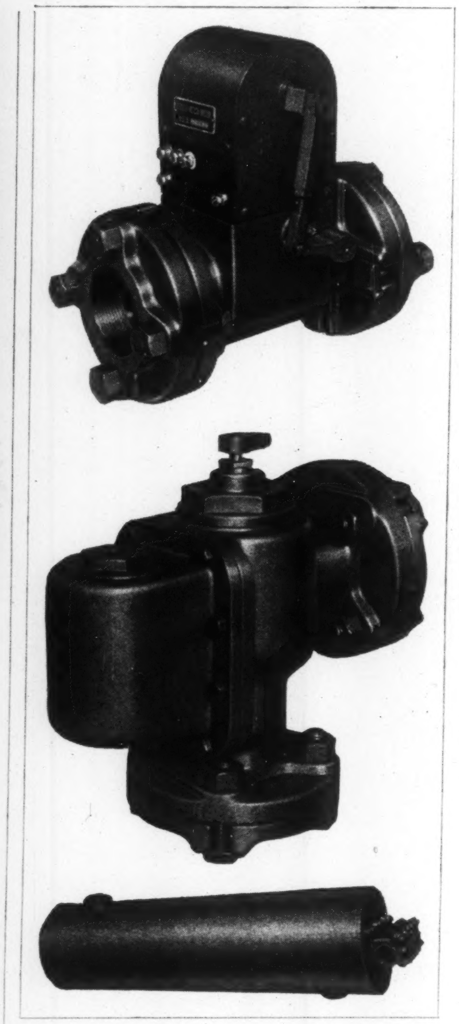
AIR CONDITIONING UTILITIES CO.
8 West 40th Street NEW YORK
ATLAS ASBESTOS CO., LTD.
110 McGill St. MONTREAL, CANADA



The valve opens in a few seconds and, as no current is used when it is opened or closed, it is economical in operation.

The "Thermo-Flo" valve combines the functions of a flow control valve with a device for preventing "over-ride" in boiler water temperature which may occur in stoker or hand fired forced circulation systems. It embodies a thermal member which opens a bypass when the boiler water reaches an excessive temperature by permitting the water to circulate by gravity to the radiators. At any temperature below this point, or when the pump is running, the thermostatic bypass is closed.

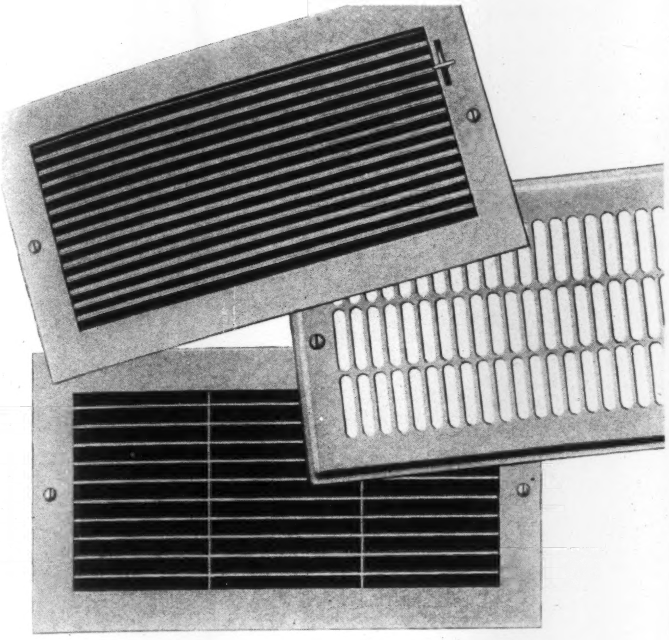
The tankless heaters are for use in apartment buildings, hotels and other buildings requiring large volumes of hot water. They can be installed below the water line and circulated with a pump, or installed above the water line and circulated by gravity. Features of construction include small boiler connections, provisions for automatic temperature control, large capacity, ease of installation, ease of cleaning, and rapid heat transfer, according to the maker. All parts in contact with service water are of copper or bronze.—Bell & Gossett Co., 3000 Wallace St., Chicago, Ill.

Panel Filters for Range Canopies

No. 1652—The "Greastop" panel filters illustrated are of all metal construction and are offered for installation on kitchen ventilation ducts to collect entrained grease and other matter, and prevent such inflammable material from accumulating in the ducts. The principle of installation is that the air is drawn from over the range up into the canopy and flues, and must pass over the filters and be cleaned of grease content. These filters are available in any reasonable size and shape, and 2 in. thickness is standard. The element is composed of bronze and galvanized wire mesh, incorporates exactly graduated density to provide the baffle-impingement principle of air filtration with low air resistance.

The element is enclosed in 16 ga welded channel steel with a permanent finish to resist heat and corrosion. Panel holding frames are of rigid steel construction, having a rolled front edge and a ¾ in. flanged back edge with fireproof felt seals to prevent air leakage around the panel.

The filters may be cleaned by swishing in a pan of hot water or directing a stream of hot water through the fine mesh side.



Modern
Air Conditioning
Demands
Modern
Registers

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PILLOW BLOCKS

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✓ for ECONOMY
✓ for BETTER PERFORMANCE
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Get all the above and more too by using Randall Pillow Blocks in your units. They are preferred by manufacturers because they eliminate bearing worries. Important features such as self-alignment, self-lubrication, minimum running torque, large oil capacity and extreme quiet make Randall performance unequalled.

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Nos. 140A and 240A One-Piece Steel Housing Pillow Blocks have double reservoir and constant full self-alignment. For shaft sizes from ½" to 1".

Universal Pillow Block—A precision machined pillow block for heavy duty work. Has double reservoir.

These two pillow blocks can be mounted in any position by unscrewing the oil cup, turning the ball, and reinserting the oil cup in a vertical position.

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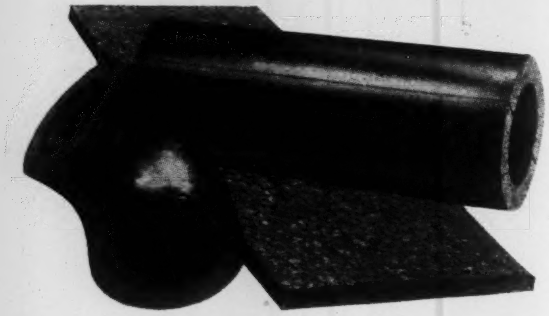

AIR CONDITIONING SYSTEMS operate more efficiently, more economically—when cold air ducts and air washing equipment are insulated with Novoid Corkboard. Made of pure cork, Novoid effectively resists the passage of heat and prevents condensation.

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Please send me complete details of Novoid Corkboard and Cork Pipe Covering for air conditioning systems.

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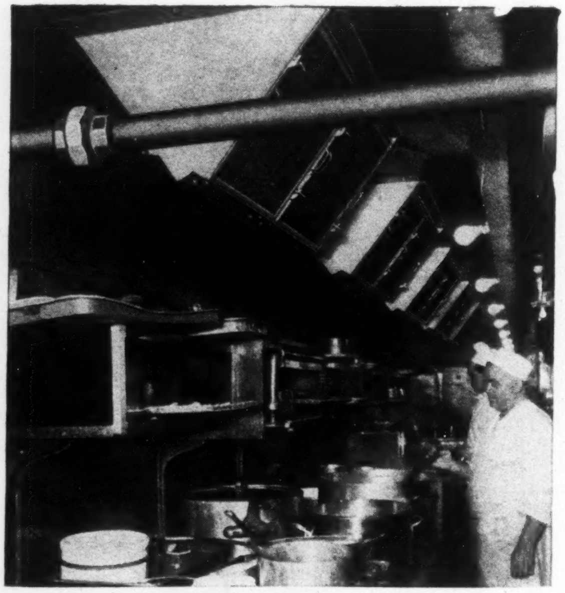

The addition of common washing soda facilitates removal of exceptionally greasy accumulations.—Air-Maze Corp., 5200 Harvard Ave., Cleveland, Ohio.

Conventions and Expositions

Midwest Power Conference: April 5-7, Palmer House, Chicago, Ill., sponsored by Armour Institute of Technology. Conference secretary, Stanton E. Winston, Armour Institute of Technology, 3300 Federal St., Chicago, Ill. Papers to be presented include Achievements of Research in Power, by L. W. Wallace; Developments in Central Station Power Plants, by Alex D. Bailey; Problems of the Small Industrial Power Plant, by F. Elwell; Small Utility, Municipal and University Power Plants, by G. A. Gaffert; High Pressure, High Temperature Metallurgy, by J. C. Hodge; Influence of Creep Studies upon Allowable Design Stresses, by J. J. Kanter; Reducing Pollution of Air by Power Plants, by R. V. Kleinschmidt; Chicago's Air Pollution Problem, by Loyd R. Stowe; and Pump and Turbine Development, by R. V. Terry.

Fourth Iowa Heating and Air Conditioning Conference: April 11-13, Iowa State College, Ames, Iowa. Papers to be presented include A Study of Heating and Ventilation of Public Schools; Engineering Contracts as Related to the Field of Heating, Ventilation, and Air Conditioning; Water Supply and Disposal for Air Conditioning in Iowa; Sales Developments in Air Conditioning; Zone Control for Automatic Heating; A Sales Program for Oil Burners; Installation and Maintenance of Service on Oil Burners; The Fuel Oil Situation; Experiments on Oil Burner Operation; Securing Satisfied Customers; Dustless Treatment for Stoker Coal; Coal Marketing in Iowa; Furnishing Complete Heating Service; Recent Developments in Coal Stoker Design; Stoker Servicing; and Summer Hot Water Problems. There will also be exhibits.

Air Conditioning Conference: April 14-15, University of Texas, Austin, Texas. Papers to be presented include Summer Comfort Cooling Requirements for the Southwest, by A. J. Rummel; Fan Selection and Use of Ducts, by J. R. Bishop; Heat Chart Method for Determining Conditions in an Air Conditioning System, and as an Aid for Selection of Equipment, by E. P. Renouf; Case Problems of Air Conditioning, by Dale S. Cooper; Storage Air Conditioning as a Revenue Builder, by D. C. Pfeiffer; and Installation and Servicing of Air Conditioning Equipment, by A. F. Avera.

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Fulton Sylphon offers architects and engineers a line of controls ideally suited to the regulation of duct temperatures in air conditioning and indirect heating and ventilating systems where heating is by steam coils in the ducts, and cooling is by circulated cold water or calcium chloride brine.

Principal reasons for Sylphon preference are: Modulating action of Sylphon controls for maintenance of desired temperatures within extremely close limits; self-contained, self-powered, compact design, easy to install, and requiring no compressed air, no wiring, motors, levers, chains or other auxiliary equipment; patented star-shaped bulbs and coil type bulbs providing unusual sensitivity; dependability of rugged all metal construction from the finest materials available; products of specialists in temperature control for over thirty years.

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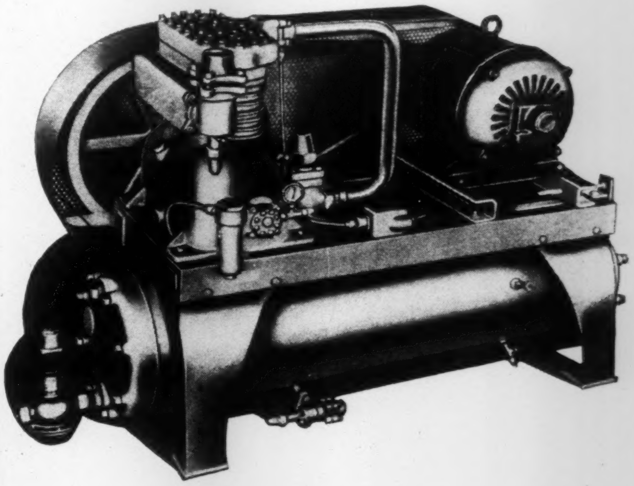

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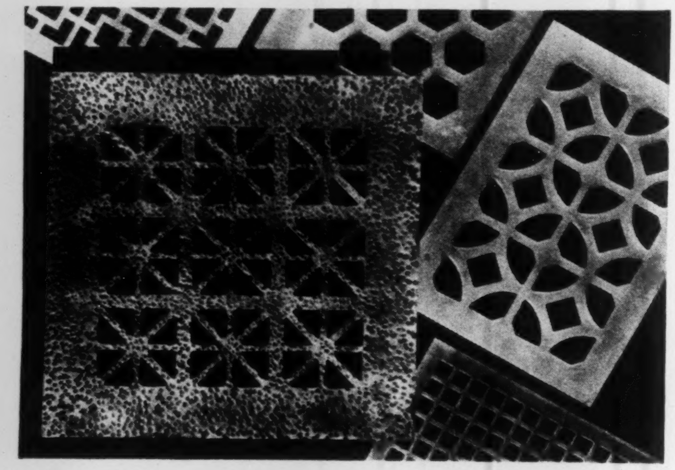
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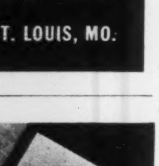
Send for the WISSCO GRILLE catalog showing suggestions of attractive modern design made with Standard dies.



WISSCO GRILLES

American Mining Congress Coal Show: April 24-28, Cincinnati, Ohio.

American Society of Refrigerating Engineers: Spring meeting, May 21-23, Hotel Hershey, Hershey, Pa. Headquarters office, 37 W. 39th St., New York, N. Y. Papers to be presented include Methyl Chloride Properties and Tables, by E. W. McGovern; Portable Testing Apparatus for Condensing Units, by D. D. Wile; Commercial Absorption Machines, by W. R. Hainsworth; Refrigeration in the Chocolate Plant, by L. S. Morse; Tests on Air Circulation in Precooling, by F. C. Lindvall; Operation of Government Conditioning Plants, by Charles A. Peters; Tests on Refrigeration Storage for Air Conditioning, by W. F. Friend; Conditioning of Passenger Buses, by C. F. Henney; Practice in Low Pressure Piping, by A. Hafke and J. L. Gibson; Practice in Ammonia Piping, by R. C. Doremus, H. C. Guild, and F. R. Zumbro; "Carrene" and "Freon" Piping, by W. H. Carrier; and Code for Pressure Piping, Refrigeration Section, by A. B. Stickney.

Association of Gas Appliance and Equipment Manufacturers: Annual convention, May 24-26, Roosevelt Hotel, New York, N. Y. Headquarters office, 60 E. 42nd St., New York, N. Y.

Heating, Piping and Air Conditioning Contractors National Association: 50th annual convention, May 31-June 2, Drake Hotel, Chicago, Ill. Headquarters office, 1250 Sixth Ave., New York, N. Y. Important subjects to be discussed include the apprenticeship program; pipe welding and training and testing welders; the trade promotion program; and the extension and further development of the certification program.

Stoker Manufacturers Association: Annual convention, June 1-2, French Lick Springs, Ind. Headquarters Office, 307 N. Michigan Ave., Chicago, Ill.

National Warm Air Heating and Air Conditioning Association: Mid-year meeting, June 5-7, Stevens Hotel, Chicago, Ill. Headquarters Office, 5 E. Long St., Columbus, Ohio.

American Pulp and Paper Mill Superintendents Association: Annual convention and exhibition, June 13-15, Wardman Park Hotel, Washington, D. C. Convention Manager, G. W. Craigie, 176 Mason St., Cumberland Mills, Me.

Smoke Prevention Association: Annual convention and exhibit, June 13-16, Hotel Schroeder, Milwaukee, Wis. Headquarters office, 139 N. Clark St., Chicago, Ill.

American Society for Testing Materials: Annual meeting, June 26-30, Chalfonte-Haddon Hall, Atlantic City, N. J. Headquarters Office, 260 S. Broad St., Philadelphia, Pa.

National District Heating Association: Annual convention, June 27-30, Hotel Pennsylvania, New York, N. Y. Headquarters office, 1317 Spruce St., Philadelphia, Pa.

American Society of Heating and Ventilating Engineers: Semi-annual meeting, July 4-6, Grand Hotel, Mackinac Island, Mich. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

American Society of Heating and Ventilating Engineers: Annual meeting, January 22-26, 1940, Cleveland, Ohio. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Sixth International Heating and Ventilating Exposition: January 22-26, 1940, Cleveland Public Hall, Cleveland, Ohio. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

Performance of Coils for Dehumidifying Air

On Fig. 11 of this article published on p. 16 of the January, 1939, HEATING, PIPING AND AIR CONDITIONING, the legends d_L and d_S were interchanged. Because of this, Equations 21 and 22 on p. 15 were incorrectly given. They should have appeared as follows:

$$d_L = h_2 - h_{R1} \qquad [21]$$
$$d_S = h_1 - h_{R2} \qquad [22]$$

While the error would be obvious in the use of the equations, as it would be realized which factor was the large enthalpy

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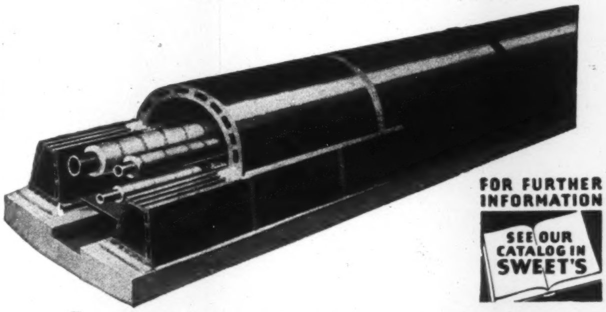

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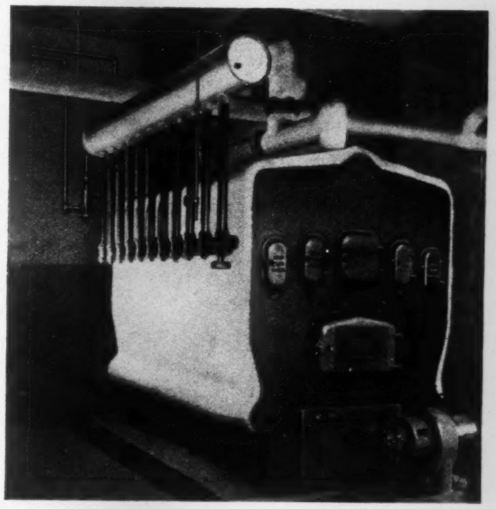

Hank **Tells About a New Hot Water Heating Contrapshun For Cast Iron Boilers**

Honest now, isn't it so, that a lot of you smart engineering fellers have been favoring steel boilers as against cast iron, because the steel ones can also do a tankless hot water supply job?

Well here's good news from home.

Here's a Burnham cast iron equipped with a Tankless Hi-Flo Taco Heater.

It's an outside job.

Inside the elevated Taco is a copper coil connected directly to the water supply, and in turn to the taps. Each section of the boiler is tapped below water line at the point where it is hottest. Each section has its separate supply connection to the Taco.

Circulation is evenly balanced. Supply lead off is equipped with water tempering valve. An aquastat controls the oil burner or stoker. A constant supply of uniform temperature hot water is assured.

No tank needed. No sediment. All tap hot water is as clear and rust free as the cold. No costly tank repairs or replacements.

You have in addition, all the advantages of easy, low cost installation that a Burnham Sectional Cast Iron Boiler gives you.

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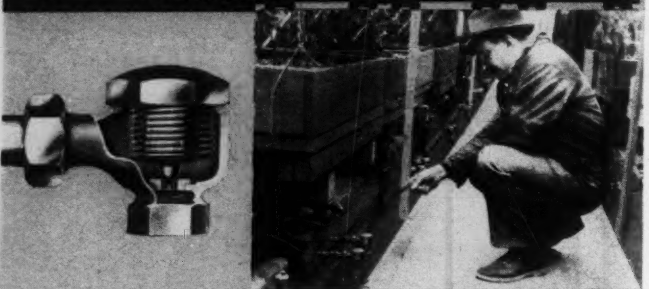
Burnham Boiler

"WE SAVED THREE CARS OF COAL"



Floral Avenue Greenhouses, Mt. Clemens, Michigan, installed 400 Sarco Type H and FT Steam Traps three years ago. They intentionally purchased $800 less coal *and* had three cars left over at the end of the year. "Better heating, absolutely no maintenance difficulties, and Sarco Traps have saved us more than twice their original cost each year."

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Sarco Radiator Traps will give you the same kind of efficiency. Time after time, building managers and contractors tell us that the cost of a changeover to Sarco was saved the first year.

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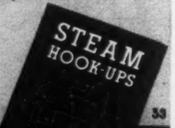

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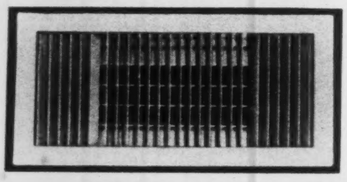

For REAL AIR CONTROL

Waterloo Air Conditioning Grilles are modern, attractive—but more than that, they are scientifically designed to control and direct air-flow. Camera Shutter Size Control, 4-way Direction Control, and Graduated Volume control, give complete flexibility for every installation. Waterloo Air-Conditioning Grilles DO THE JOB.

Write for latest catalog.

WATERLOO REGISTER CO.
Waterloo, Iowa Seattle, Wash.

difference and which was the small one, it is unfortunate that the transposition occurred.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 130. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to Heating, Piping and Air Conditioning.

No. 3101. AIR CONDITIONERS: Frick Co., Waynesboro, Pa. 4 p. bulletin (520-A) on new line of unit air conditioners, giving information on where they should be used, general design, how they are installed, method of operation, and presenting specifications. Advantages of air conditioning are summarized.

No. 3102. AIR CONDITIONING EQUIPMENT: Parks-Cramer Co., 970 Main St., Fitchburg, Mass. 14 p. issue of "Parks' Parables" dated March, 1939, listing and describing the manufacturer's various products, including air changers, humidifiers, central station and unit air conditioners, automatic regulators, humidity measuring instruments, valves and accessories, etc.

No. 3103. AIR HANDLING EQUIPMENT: American Blower Corp., 6000 Russell St., Detroit, Mich. Broadside illustrating equipment and facilities of this company, and featuring research as the foundation of modern means of air handling.

No. 3104. BEARINGS: Johnson Bronze Co., 460 S. Mill St., New Castle, Pa. 72 p. catalog (390) covering general purpose bearings, oil grooving, motor bearings, graphite bearings, and other data. Also a comprehensive 24 p. price list on bearing bronze.

No. 3105. BELTING: E. I. du Pont de Nemours & Co., Inc., Rubber Chemicals Div., Wilmington, Del. 4 p. issue of "The Neoprene Notebook" (Vol. 2, No. 12) featuring an article on belting for resisting deterioration from heat, chemicals and oils, illustrating various drives, and reporting operating data on them.

No. 3106. BOILERS: Edge Moor Iron Wks., 30 Rockefeller Plaza, New York, N. Y. 4 p. bulletin (105) on low head water tube boilers from 100 to 600 hp and 125 to 900 lb pressure.

No. 3107. BOILER SERVICE UNITS: Roots-Connersville Blower Corp., 16th St. and Columbia Ave., Connersville, Ind. Supplemental bulletin (Form B14-HB) on a new line of horizontal boiler service units for boilers up to 500 hp and pressures up to 150 lb. Units are adapted to condensate return for gravity systems, combination return and boiler make-up, and direct feed boiler supply.

No. 3108. DIE HEADS: Landis Machine Co., Inc., 5th and Church Sts., Waynesboro, Pa. 12 p. bulletin (F-80-3) on hardened and ground die heads, illustrating and describing them and giving engineering data.

No. 3109. EYE SHIELDS: Jackson Electrode Holder Co., 15122 Mack Ave., Detroit, Mich. Folder on eye shields for welders and other uses, describing and illustrating various available types and advantages.

No. 3110. FEED WATER CONTROL: Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, Ohio. 16 p. bulletin (105) on three element feed water control, describing a system which measures feed water flow to the boiler, steam flow from the boiler, and boiler water level, and which functions to control feed water input to equal steam output at all times.

No. 3111. GASKETS FOR RING JOINTS: Goetze Gasket & Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J. 2 p. revised bulletin (51A) on oval and octagonal rings, listing standard gaskets for ring joint flanges in "Armco" iron and 4-6 chrome alloy. It contains dimensions and prices for API standard size rings from No. 11 to No. 79, and rings for pipe from ¾ in.

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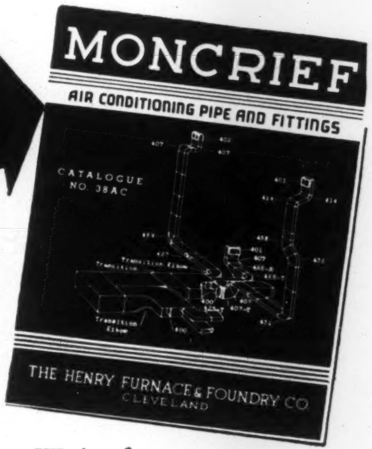
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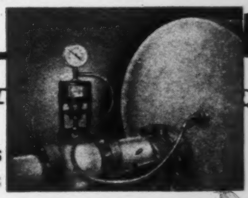

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EASY TO INSTALL—Both thermometer and regulator operate from the same thermal system.

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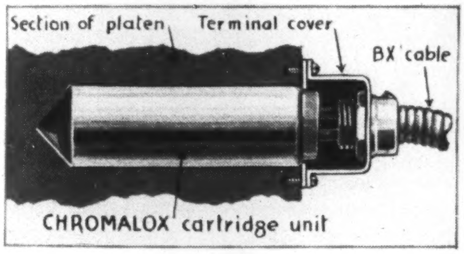
How to apply ELECTRIC HEAT to platens, molds, dies, and other machine parts



A drilled hole to receive the heating unit, and a couple of small tapped holes for the screws holding the terminal cover, are all that are necessary to supply electric heat to a table, platen, mold, revolving roll, or other machine part requiring heat.

Chromalox cartridge units, shown in the illustration, are used extensively for this purpose. They are made in capacities from 50 to 2000 watts, in diameters from 3/8 in. to 1 19/64 in., in various lengths and with brass sheaths as standard, but also in copper, steel and stainless for immersion in various liquids.

The inner construction of these units insures long life and extreme economy. The resistance wire is packed in refractory material which protects it against vibration and mechanical shock, and against oxidation.

With these units, the advantages of close temperature control by thermostat, and elimination of fire hazard, are secured.

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An engineering staff of electric heat experts is ready to cooperate in developing the correct method of applying these and any other Chromalox units a job may require. Write for the Chromalox 64 page catalog.

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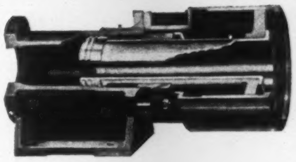

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UNPACKED *and* REPACKED
Under Full Operating Pressure

No interruption to service. Piston Rings in the internal guide hold the line pressure during the unpacking and repacking operation.

Fully guided by an internal guide ring and by an external guide in the two-piece hood. Available in single or double joints for high pressures and high temperatures with flanged or beveled ends.

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- Northwestern University, Evanston, Ill.
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- Standard Oil Company of California.
- Johnson Wax Company, Racine, Wis.
- Arapaho Indian Agency, Concho, Okla.
- City of Kingston, Kingston, N. C.
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The extra-wide seats in Dart Unions give you extra long service. For Darts assure wide, full-bearing contact over the entire seating surface. They do this because they're ground to a true ball joint, assure leak-proof seating repeatedly under long, hard usage.

Moreover, air-refined malleable iron bodies and nuts resist pipe strains, wrench abuse, and thread distortion.

Dart's **repeatable tightness** means repeated savings. For every time you re-install a Dart, you save the cost and the trouble of a replacement. Darts save on maintenance, too. They stick with their jobs—prevent leaks, lost time, and wasted labor.

Send today for a Dart to try at our expense.

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to 24 in. and for working pressures from 300 to 600 lb and 900 to 1500 lb.

No. 3112. LUBRICATION: Texas Co., 135 E. 42nd St., New York, N. Y. 24 p. issue of "Lubrication" (Vol. 25, No. 2) devoted to improvements in petroleum products over recent years and including sections on refrigeration and air conditioning compressor oils and industrial lubrication.

No. 3113. MOISTURE IN REFRIGERATING SYSTEMS: E. I. du Pont de Nemours & Co., Inc., R. & H. Chemicals Dept., Wilmington, Del. 8 p. issue of "Artic Service News" featuring an article by E. W. McGovern on moisture in refrigerating systems with information on effects of moisture, sources, drying methods, dryers and drying agents.

No. 3114. MOTORS: Allis-Chalmers Mfg. Co., Milwaukee, Wis. 4 p. leaflet (2125-C) on explosion proof motors, briefly describing them and illustrating installations.

No. 3115. MOTORS: Allis-Chalmers Mfg. Co., Milwaukee, Wis. 4 p. leaflet (2183A) on "Lo-Maintenance" direct current motors and generators, describing and illustrating the equipment and details of construction.

No. 3116. MOTORS: Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill. 4 p. issue of "The Motorgram" (Vol. 19, No. 2) including an article on how special purpose motors are rated.

No. 3117. PUMPS: Allis-Chalmers Mfg. Co., Milwaukee, Wis. 4 p. leaflet (2199-C) on single suction, single stage close coupled utility pumps for handling from 10 to 1600 gpm and using motors up to 75 hp. A cross section with a detailed description of each part is included.

No. 3118. PUMPS: Pomona Pump Co., 206 E. Commercial St., Pomona, Calif. 8 p. bulletin (30) announcing "Little Chief" pump, an all service pump which is offered for industrial and general service purposes. A technical description, illustrations, and information on capacities and ordering are included.

No. 3119. PUMPS: Worthington Pump and Machinery Corp., Harrison, N. J. 8 p. bulletin (W-319-B1A) on high pressure, high temperature centrifugal boiler feed pumps including a complete description, installation views, and listing installations with conditions of service.

No. 3120. REFRACTORY CEMENTS: Pyrolite Products Co., 1221 W. 74th St., Cleveland, Ohio. Folders on "Radolite" refractory cements, furnace cements, plastic furnace lining and heat resisting black paint.

No. 3121. REFRIGERATING EQUIPMENT: Brunner Mfg. Co., 1821 E. Broad St., Utica, N. Y. 32 p. catalog presenting the complete 1939 line of this manufacturer's condensing units and which comprises over 80 air and water cooled models for refrigerating and air conditioning applications from ¼ to 15 hp. A number of refinements in design and construction are included, among which are major changes in valve design, larger condensing surfaces and improved general appearance. Complete and simplified data on how to select the proper model are included, with capacities based on ASRE ratings, and general engineering information is given.

No. 3122. REFRIGERATION PRODUCTS: Merchant & Evans Co., 2035 Washington Ave., Philadelphia, Pa. 40 p. catalog of refrigeration compressors illustrating and describing the various units and containing complete capacity tables for low temperatures, standard temperatures and air conditioning temperatures.

No. 3123. RUBBER COMPOUNDS: Self-Vulcanizing Rubber Co., Inc., 605 W. Washington Blvd., Chicago, Ill. 12 p. booklet on plastic and liquid rubber compounds for providing protection against corrosion, abrasion and chemicals, which are cold curing. A new product is a primer coating material that dries cold to a solid surface within an hour and withstands temperatures to 212 F, according to the manufacturer.

No. 3124. SHEARS AND PRESSES: Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo, N. Y. Broadside giving pictorial resumé of this manufacturer's presses and shears, with illustrations showing constructional features.

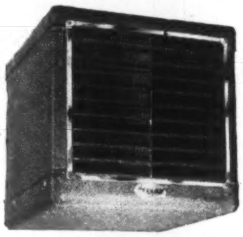
McQUAY
For Every Phase of
AIR CONDITIONING

AIR CONDITIONERS
(Suspended Type)

The Series "S" Line is designed in many capacities and sizes for stores, cafes, theaters, etc. Adaptable for outside air connections. Ease of installation. Attractive cabinets. Centrifugal fans and filters are used. Cold water or Freon as cooling medium.

COMFORT COOLERS
(Suspended Propeller Type)

A size to fit any requirement. For Direct Expansion refrigerants; also available as combination cooling and heating units, where cold water or brine is used as cooling medium, or steam or hot water as heating medium.

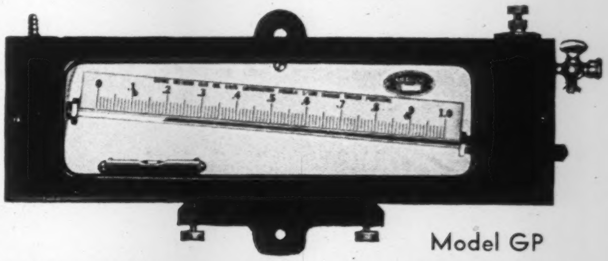


Interesting Bulletins are available on models illustrated, as well as on many other types of air conditioners.

McQUAY AIR CONDITIONING UNITS HAVE ABLY GAINED LEADERSHIP THROUGH LONG
PERFORMANCE
STABILITY and
ECONOMY

"Low First Cost" sensibly combined with "AFTER cost" OPERATION.

McQUAY, INC.
MINNEAPOLIS, MINNESOTA.



Model GP

Meriam Draft Gauges

This easily read, easily adjusted gauge is used to measure the flow of low pressure air or gas, when employed in conjunction with an orifice plate or pitot tube (should the maximum differential not exceed two inches of water) . . . also, to check resistance across air filters . . . and to show draft at various points in boiler setting.

Write for Bulletin No. 4 giving full information and prices on the complete range of MERIAM SINGLE and MULTI-TUBE DRAFT GAUGES.

The Meriam line also includes a full line of "U" and Well-Type Manometers to meet every requirement of air conditioning engineers.

THE MERIAM Co.
Instruments for Indicating Pressure or Flow of Liquids and Gases
CLEVELAND • OHIO

REDWOOD BARK
Supplies the insulation that has what it takes for
AIR CONDITIONING

NON-SETTLING
REPELS MOISTURE
ODOR-PROOF
VERMIN-PROOF
FIRE-RETARDANT
EASY TO INSTALL

FOR COMFORT AND ECONOMY
PALCO
INSULATION
WOOL
THE INSULATION OF THE AGES

FREE
16-page
House
Insulation
Manual

PERMANENT THERMAL EFFICIENCY
.255 B.t.u. Peebles
AT LOWEST POSSIBLE COST

PALCO
INSULATION
T.M. Reg. U.S. Pat. Off.
WOOL

THE PACIFIC LUMBER COMPANY
SAN FRANCISCO CHICAGO LOS ANGELES NEW YORK

SMALL SIZE
will fit in palm of your hand

BIG
CAPACITY

POWERS TRAPS

Compare a POWERS Trap with the best trap you ever had. *Test it for 90 Days* • They're easy to install — Simple to adjust — Get more heat out of your steam and Reduce Repair costs • Write for Circular 4005.

THE POWERS REGULATOR COMPANY
2759 GREENVIEW AVENUE, CHICAGO, ILLINOIS — OFFICES IN 47 CITIES

Heating, Piping and Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [4-39]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1640	1641	1642	1643	1644	1645	1646
1647	1648	1649	1650	1651	1652	
3101	3102	3103	3104	3105	3106	3107
3108	3109	3110	3111	3112	3113	3114
3115	3116	3117	3118	3119	3120	3121
3122	3123	3124	3125	3126	3127	

Name.. Title............

Company ....

Address ....

City.. State............

No. 3125. TELEMETERING: Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, Ohio. 16 p. bulletin (194-A) on the manufacturer's "Synchro-Meter" for transmitting and indicating, recording or integrating, the measuring of any factor such as flow, level, pressure and temperature at distant points. Operation and accuracy of the device is described and wiring diagrams illustrating the principle of operation are included.

No. 3126. VALVES: Manning, Maxwell & Moore, Inc., Hancock Valve Div., 11 Elias St., Bridgeport, Conn. 4 p. bulletin on "Duravalve" with integral stellite seat offered for 1500 lb, 950 F service, and giving a list of installations, test reports and other engineering data.

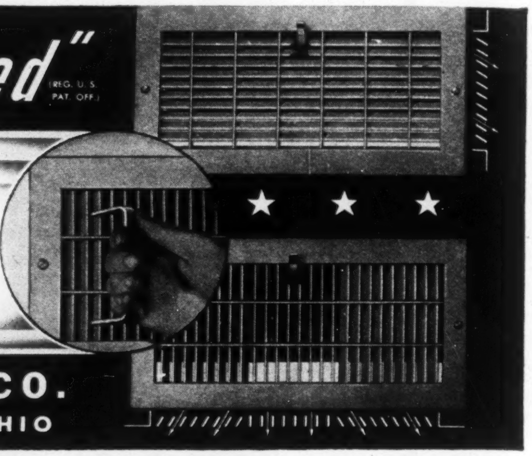
No. 3127. WELD EXAMINATION: E. Leitz, Inc., 739 Fifth Ave., New York, N. Y. 4 p. pamphlet describing a binocular prism magnifier for the examination of welds and welding seams for penetration, porosity, and cracks.

INDEPENDENT "Fabrikated" (REG. U. S. PAT. OFF.)

adjustable DIRECTED AIR FLOW REGISTERS *and* GRILLES

Every grille bar can be INDIVIDUALLY adjusted either before or after installing. *Send for catalog.*

839



THE INDEPENDENT REGISTER CO.
3747 EAST 93RD STREET CLEVELAND, OHIO

A REAL JOB!

33 STORIES OF AIR-CONDITIONED COMFORT

PHILADELPHIA SAVINGS FUND BANK BUILDING

HEAT INSULATIONS
for DUCTS • PIPE • EQUIPMENT
by Carey (REG. U.S. PAT. OFF.)

All that is BEST in ENGINEERING • MATERIALS • SERVICE

THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
BRANCHES IN PRINCIPAL CITIES

"INDUSTRIAL AIR CONDITIONING PRACTICE"

324 Pages—$2.50

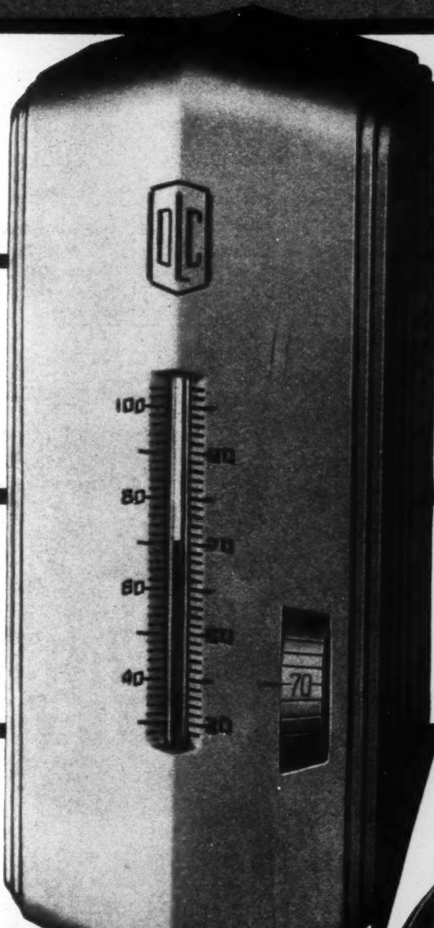
A comprehensive treatment of the profitable application of air conditioning in manufacturing processes. Fully describes air conditioning systems operating today in 14 different types of industrial plants. Every engineer, contractor, and salesman interested in this field of air conditioning should own a copy. Remit $2.50 with order.

KEENEY PUB. CO., 6 N. MICHIGAN AVE., CHICAGO

THE CONVENTIONAL THERMOSTAT PREHEATER—AS DESIGNED FOR THE

TWO-ELEVEN

Is the Only One that Affords these Important Advantages



1 Preheater is not in load circuit, therefore it is not affected by variations in load.

2 Length of heating cycle is quickly adjusted with merely the aid of a screw driver.

3 The Preheater element for the Two-Eleven is the same for all instruments and all installations—dealers are not called upon to stock assorted heater elements.

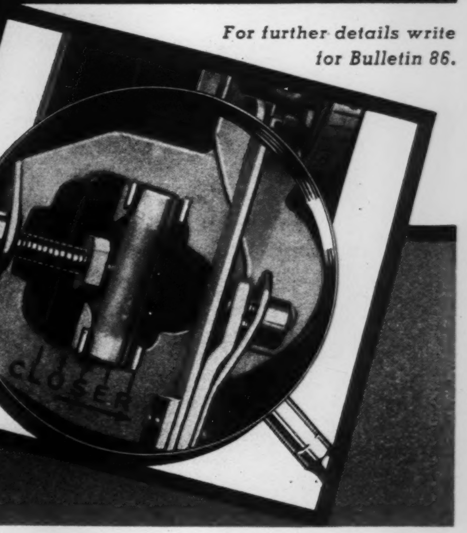
4 No need to change the air gap adjustment on the bimetal blade.

5 No appreciable sag in indoor temperature curve because of the special construction of the Two-Eleven and the close balance between preheater output and thermostat differential.

6 Maximum sensitivity due to elimination of mass effect adjacent to the bimetal blade which leaves the blade free to react quickly to slight variations in air temperature.

7 Sturdy construction—modernistic styling that harmonizes with all interiors.

For further details write for Bulletin 86.



DETROIT LUBRICATOR COMPANY

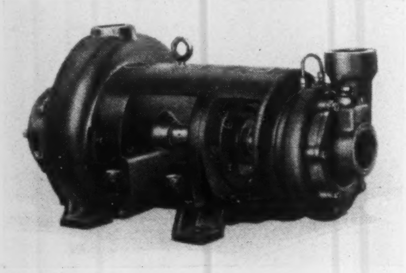
General Offices: DETROIT, MICHIGAN

Canadian Representatives: Railway & Engineering Specialties Ltd., Montreal, Toronto, Winnipeg

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 134. Add the new products and companies listed here to your Directory Section which you received in your January, 1939, HEATING, PIPING AND AIR CONDITIONING and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Turbine Driven Pumps



No. 1653—A group of compact turbine driven centrifugal pumps is the latest addition to the line of "Monobloc" centrifugal pumping units. They are for use where there is a fire and explosion risk from chemicals, gasoline, dust, oil or gas.

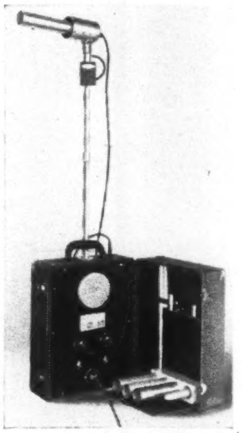
Capacities range from 10 to 400 gpm at 10 to 240 ft total dynamic head, with steam pressures ranging to 300 lb per sq in. maximum. Pump fittings may be had in standard bronze, iron or special materials.—Worthington Pump and Machinery Corp., Harrison, N. J.

New Cord for V-Belts

No. 1654—A new super-flex V-belt made from "Daytex" cord has been announced which has improved tensile strength, lower stretch and, due to interlocked fibers, minimum tendency to become lifeless, according to the maker.

In the process of manufacturing the cord, a bonding-compacting agent removes the non-essential oils and waxes from the outside of the individual fibers in order to cause the fibers to interlock and form a strong yet compact cord. The cord is used in the neutral axis of the belts. Further processing after introducing special rubber compounds normalizes the cord until the stretch is removed from the belt.—Dayton Rubber Mfg. Co., 2345 W. Riverview Ave., Dayton, Ohio.

Dust and Fume Sampler



No. 1654—The new instrument illustrated has been designed for the quantitative sampling of dust, fume and mist and employs the principle of pre-ionization with electrostatic precipitation. It may be used for sampling from the general atmosphere or from stacks or ducts, and—according to the maker—is an efficient sampler for fumes, particularly lead fumes.

It operates on 110-120 volts, 60 cycle, alternating current. Case dimensions are 14½x11¼x7¾ in. and the weight is less than 25 lb.—Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa.

Refrigerant Leak Alarm

No. 1655—The leak alarm illustrated warns the operator of an air conditioning or refrigerating plant that the system has

Another Reason You'll Make More Money with the Complete CURTIS Line

The Curtis STORE and OFFICE COOLER

● Long known as one of the most profitable lines in the industry, the addition of the Curtis Refrigerated Store and Office Cooler now makes it even more attractive to you. It opens up a great new market — makes possible more sales and profits.

All classes of retail establishments—stores, offices, banks, etc., are demanding air conditioning now. You can fulfill this demand with Curtis' complete, factory designed, packaged air conditioning unit. It mechanically cools, dehumidifies, circulates and filters the air — adaptable for heating — easily and quickly installed — 3 and 5 ton sizes.

The Curtis line of condensing units includes sizes from 1/6 to 30 H.P., air and water cooled. There's a Curtis model for every refrigeration and air conditioning requirement—also unit coolers, coils, evaporative condensers, etc., precision engineered to deliver economical, efficient, care-free performance.

If you're interested in profits, in increasing your sales, write to Curtis for complete information today.

Curtis Refrigerating Machine Company
Division of Curtis Manufacturing Co.
1950 Kienlen Avenue, St. Louis, Mo.

"Builders of Condensing Units Since 1922"

CURTIS REFRIGERATION AIR CONDITIONING AND COMMERCIAL

45 Air Cooled Units–42 Water Cooled Units–1/6 to 30 H.P.

STEP-UP AIR DUCT EFFICIENCY with OZITE HAIR-FELT DUCT INSULATION

THERMAL CONDUCTIVITY ONLY 0.246 BTU'S

You'll lose fewer BTU's, from furnace to register, if your air ducts are wrapped with OZITE Air Duct Insulation . . . it gives lasting protection against heat loss in winter and heat penetration in summer . . . makes every kind of air-duct system more efficient, less expensive to operate.

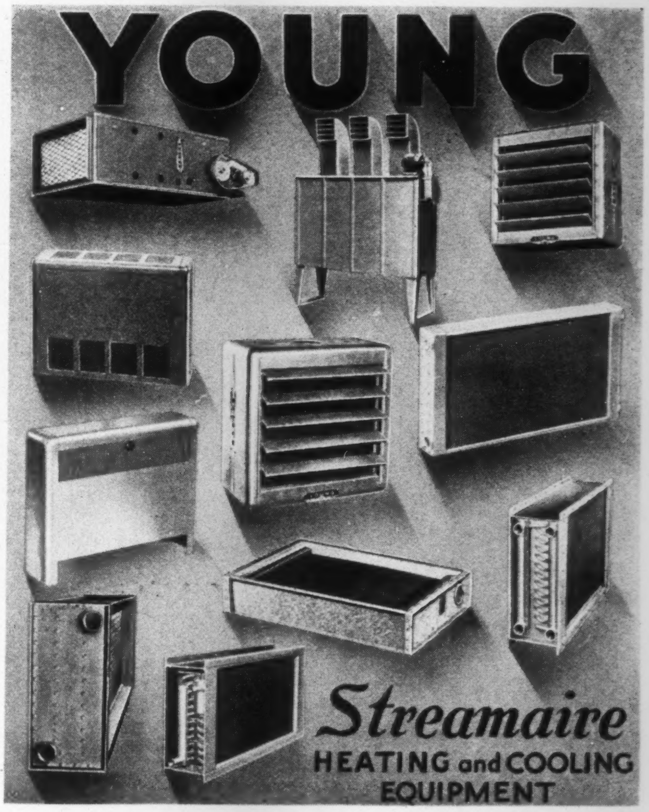
OZITE Air Duct Insulation is flexible, easy to shape, amazingly simple to install. Made of genuine hair felt—repels vermin, resists fire and moisture, won't rot or decay. Comes in rolls in 3 thicknesses.

AMERICAN HAIR & FELT COMPANY
Merchandise Mart, Chicago

OZITE Hair Felt Products for every type of heating and air-conditioning system:

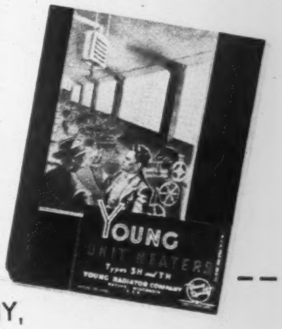
- AIR DUCT LINING—Deadens air-borne noise; reduces vibratory noises of motors, compressors, etc.
- PIPING INSULATING FELTS—For covering cold water, ammonia and brine pipe lines; also steam, vapor and hot water pipes.
- ACOUSTICAL FELTS—Sound-absorption and sound-deadening material for motor bases and housings.

SEND FOR SAMPLES AND CATALOG WITH FULL INFORMATION



Whatever your heating or cooling problems, you will find a practical, economical solution in selecting a YOUNG product. Satisfactory past performance prompts many architects, heating contractors and engineers to specify YOUNG units for they know that YOUNG design incorporates every modern phase of heat transfer, and that the units are light in weight, easy to handle and install, compact and attractive in appearance.

The YOUNG representative in your territory is a competent heating engineer thoroughly versed in the science of heat transfer. He has a knowledge of local conditions and will aid you without cost or obligation.



FILL OUT THE COUPON

Catalogs are available on all products illustrated, giving full description, capacities, working tables and installation drawings.

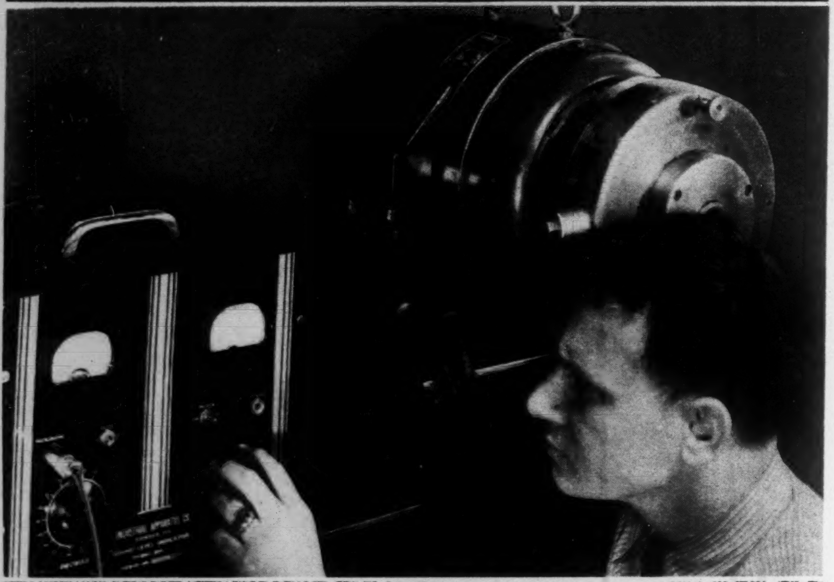
YOUNG RADIATOR COMPANY,
607 S. Marquette St., Racine, Wis.

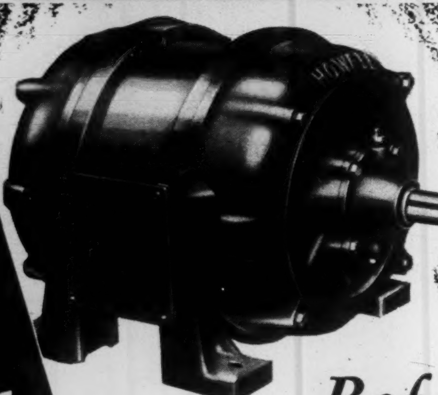
Gentlemen: I desire the following catalogs:

☐ 4037 STREAMAIRE Convectors
☐ 2738 SH Unit Heaters
☐ 336 FH Unit Heaters
☐ 6538 FC Heating Units
☐ 5537 Cooling Coils
☐ 4536 Heat Transfer Surfaces

Name ....
Firm ....
Street ....
City .... State ....

FINAL TEST on Every Motor is for QUIETNESS★





COMPLETE LINE OF MOTORS TO MEET Any Type of Air Conditioning Requirement

Before They Reach the Job—WE KNOW THAT EVERYTHING IS RIGHT!

Even with precision standards, "things" can go wrong! That's why HOWELL Motors are so *carefully* tested during each step in their manufacture . . . *and the final test on every HOWELL Motor is for quietness.*

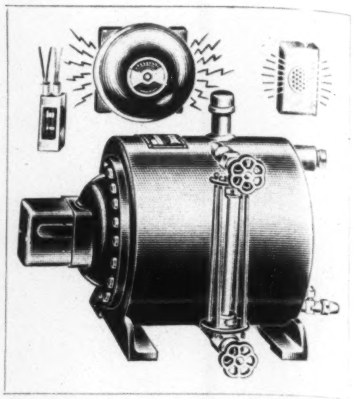
Thus, no matter how tough the job—how exacting the requirements—you can stake your reputation on HOWELL Motors, which are now driving a goodly share of all air conditioning equipment in operation.

Have you tried a HOWELL lately? Write for Bulletin 1126F covering our complete line.

HOWELL RED BAND MOTORS Make Good on Hard Jobs

★ *HOWELL Quietness Test (shown above) is made in soundproof laboratory. Microphone is located one foot from motor which is operating at full load speed. Results are read in decibels. A most exacting test—not only proving the QUIETNESS of HOWELL Motors, but that every motor is mechanically and electrically RIGHT.*

HOWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN
Representatives In All Principal Cities

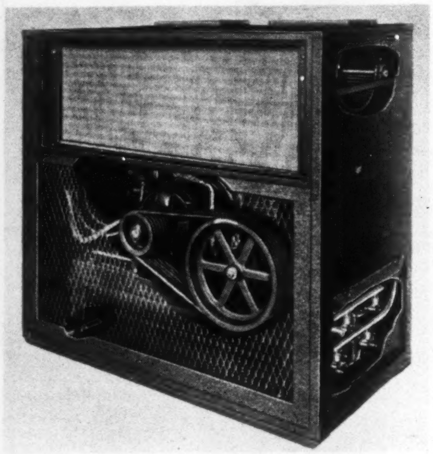


become short of refrigerant. It consists of a small liquid receiver which serves as a float chamber for the internal float. This chamber is connected to the large liquid receiver and the refrigerant level is registered by the float which operates a mercury tube switch that will make or break contact as the level rises and falls. When the level falls below the prescribed limit, an alarm bell is rung and in addition a red light provides a visual signal.

The float chamber is equipped with a liquid gage glass to readily determine the liquid level at all times. This enables the engineer or operator on a new installation, as well as on an old plant, to charge gas to the proper amount without overcharging the system. The charging or service valve at the bottom of the float chamber is for removing and recharging liquid in proper quantities for test purposes.—Reliance Refrigerating Machine Co., Inc., 3401 N. Kedzie Ave., Chicago, Ill.

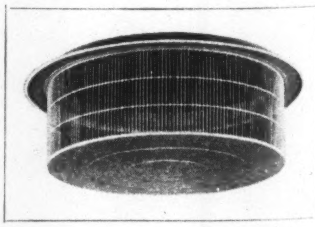
Larger Air Conditioning Units

No. 1656—Two new and larger self contained air conditioning units supplement the maker's 3 ton unit produced last year. The 5 ton unit presents a new feature in distribution by "individual vane control" of the air outlet grilles. It is a portable unit and occupies a floor space of 44 by 22 in. The 10 ton unit is designed for use with supply and return air duct connections to the areas to be conditioned.—Delco Frigidaire Conditioning Div., General Motors Sales Corp., 1420 Wisconsin Blvd., Dayton, Ohio.



Ceiling Outlets

No. 1657—These new ceiling outlets, of which the circular discharge type is illustrated, are available also in a square type with grilles of perforated metal, or with "Fabrikated" adjustable directed air flow grilles. The circular model has perforated metal grilles. Deflecting cones for aiding in distributing heated air lower and farther into the room are optional with both the circular and square types. If it is desired to attach a lighting fixture, round openings may be placed in the bottom plate as specified. These bottom plates are removable to aid in installation.



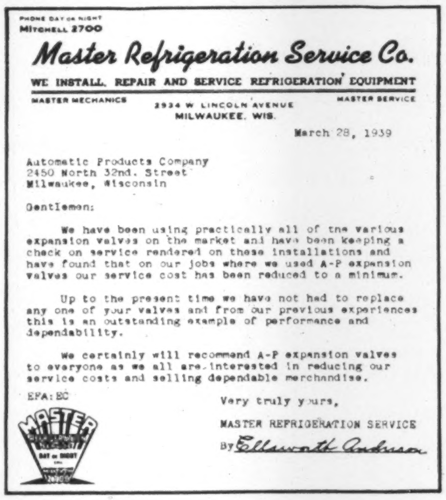
According to the maker, with this style of outlet either cooled or heated air can be handled at higher velocities without danger of drafts. In cooling work, this style of outlet introduces the cooled air at the ceiling, from which point it settles throughout the room.—Independent Register Co., 3747 E. 93rd St., Cleveland, Ohio.

"Expansion Valves have reduced our service costs to a minimum . . ."

Ellsworth Anderson
President and Owner
Master Refrigeration Service Co.

New Modern Home of Master Refrigeration Service Co., Milwaukee, Wisconsin.

MASTER REFRIGERATION SERVICE CO.
Master
REFRIGERATION EQUIPMENT



PHONE DAY OR NIGHT
MITCHELL 2700

Master Refrigeration Service Co.

WE INSTALL, REPAIR AND SERVICE REFRIGERATION EQUIPMENT

MASTER MECHANICS — MASTER SERVICE

2934 W LINCOLN AVENUE
MILWAUKEE, WIS.

March 28, 1939

Automatic Products Company
2450 North 32nd. Street
Milwaukee, Wisconsin

Gentlemen:

We have been using practically all of the various expansion valves on the market and have been keeping a check on service rendered on these installations and have found that on our jobs where we used A-P expansion valves our service cost has been reduced to a minimum.

Up to the present time we have not had to replace any one of your valves and from our previous experiences this is an outstanding example of performance and dependability.

We certainly will recommend A-P expansion valves to everyone as we all are interested in reducing our service costs and selling dependable merchandise.

EFA:EC

Very truly yours,

MASTER REFRIGERATION SERVICE

By Ellsworth Anderson

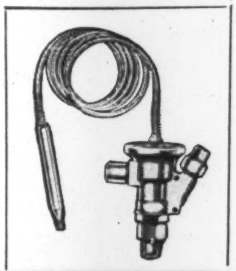
The MASTER MECHANICS of REFRIGERATION

know the surest way to reduce service costs is Better Quality Valves. So the majority now use A-P Valves on every new installation . . . And on every Valve replacement job, too.

These Valves have never let them down, for every one is designed and built especially for "outstanding performance and dependabilty." Use them for every size and type of installation.

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN

•*Refrigeration Parts Jobbers, Who Recognize Quality, Stock A-P Valves.*



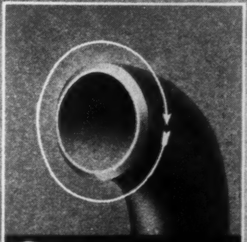
DEPENDABLE

THE BYWORD FOR A-P CONTROLS

These features—combined in no other welding fittings . . . mean better pipe welding at lower cost. It *pays* to use—

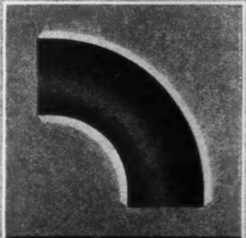
TAYLOR FORGE **WeldELLS** SEAMLESS FITTINGS FOR PIPE WELDING

TAYLOR FORGE & PIPE WORKS, General Offices and Works:
Chicago, P. O. Box 485. New York Office: 50 Church St.



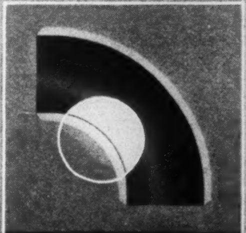
① SEAMLESS

No seam means no "question mark." Forged and formed seamless by Taylor Forge, WeldELLS represent seamless fittings in their highest development.



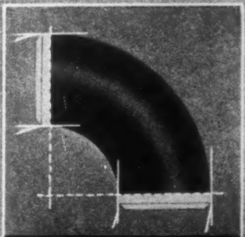
② UNIFORMLY FULL PIPE THICKNESS

All sections are at least full pipe thickness. There is no thinning of the back wall.



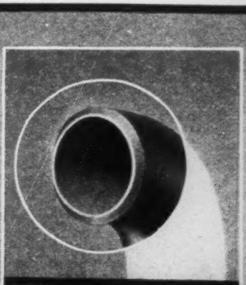
③ SELECTIVE, UNIFORM REINFORCEMENT

A typical refinement based on thorough-going research.



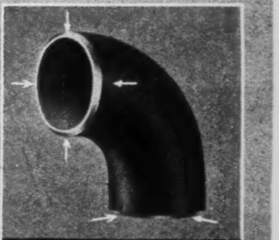
④ TANGENTS

This feature, pioneered by Taylor Forge, removes the weld from the curved section—also makes all welding a simple, straight-away operation.



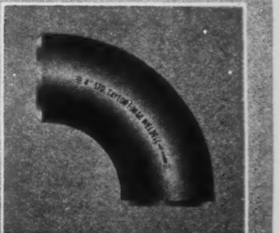
⑤ MACHINE TOOL BEVELLED

Another feature originated by Taylor Forge. It provides a clean, square and accurate welding surface that enables the welder to do a better job.



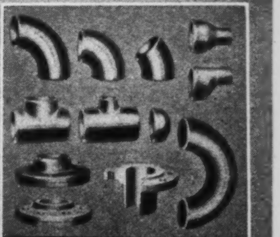
⑥ ENDS MARKED IN QUARTERS

A patented feature that means less layout work in the field; faster lining up.



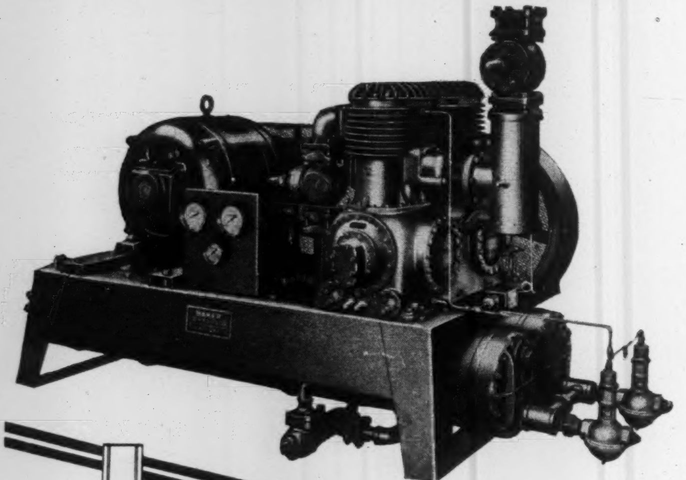
⑦ COMPLETE IDENTIFYING MARKS ON EVERY FITTING

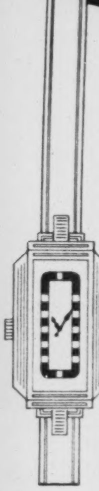
Name, size and weight are rolled on every Taylor Fitting for quick and positive identification.



⑧ A FULL LINE

The Taylor Forge line contains the largest number of types in the largest range of sizes and thicknesses.





As COMPACT as a Watch

BAKER INTRODUCES

60-TON CAPACITY AIR CONDITIONING EQUIPMENT ASSEMBLED AS A SELF-CONTAINED UNIT

Here's BIG news for users of BIG equipment. BAKER presents this outstanding condensing unit—complete with dual condensers, motor, and ALL CONNECTIONS mounted as a self-contained unit—which is as compact as a watch, especially quiet in operation, and precision manufactured. It saves nearly half the floor space usually required for the ordinary condensing unit, yet every part is easily accessible for adjustment. For complete information, write to

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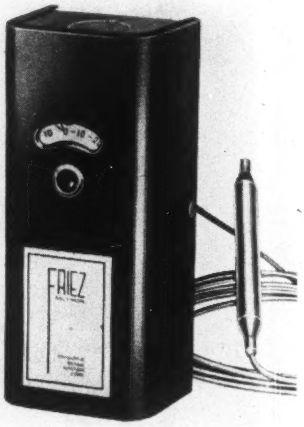
Refrigeration Controls



No. 1658—A new line of refrigeration temperature and pressure controls features the "Hydraulic-Action" principle. Solid liquid charges, from which all gases have been excluded, actuate the switch contacts. Loads of 25 amperes at 120 volts, 15 amperes at 240 volts, can be carried without relays, according to the maker.—Julien P. Friez & Sons, 4 N. Central Ave., Baltimore, Md.

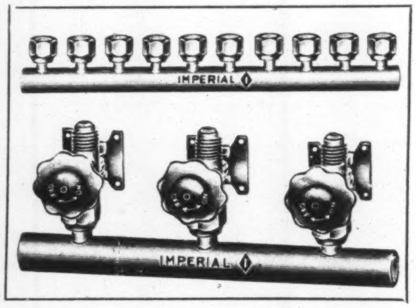
Silica Gel Dehumidifiers

No. 1659—New silica gel dehumidifiers are to be produced in three sizes, 600, 1300 and 2700 cfm, according to present plans. The new design of the equipment is simple, but different in that the silica gel adsorbent material is carried in a cylindrical basket that turns continuously. Both the conditioned air and heated air streams are continuous and simultaneous in flow. Dividing seals inside the cylinder separate the two air streams.

Cooling is accomplished by the evaporation of water into the dry air produced by the dehumidifier. This partial resaturation is effected in a new resaturating spray cooler recently developed concurrently with the new dry air machine. This resaturation, of course, is not sufficient in extent to impair the requisite drying effect. In this way, independent control of humidity and temperature is provided.—Bryant Heater Co., 17825 St. Clair Ave., Cleveland, Ohio.

Copper Tube Manifolds

No. 1660*—New hard copper tube manifolds for use with standard two-way line valves for refrigeration and air conditioning work have been announced. The maker is promoting the idea of buying manifolds "in bulk"—that is, with 12 openings and then cutting the manifold for the required number of valve openings with a tube cutter. For those who prefer manifolds cut to length, they are also sold with 2, 3, 4, 5 and 6 valve openings as well as with 12.



They are made from Type K copper pipe and are furnished with flare connections, having a brass forged flare nut, or with solder connections.—Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.

Heating and Cooling Coils

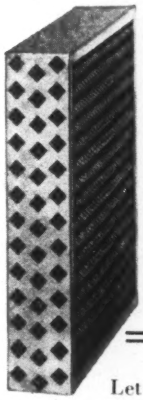
No. 1661—The heating and cooling sections or coils illustrated have been designed for low resistance to air flow, according to the manufacturer. Steam or hot water may be used for heating and cold water or refrigerant for cooling. The finned copper tubes, which are individually replaceable, are made in a hairpin shape to prevent damage from expansion and contraction and are secured to the headers by a mechanical compression joint.

NO
REPLACEMENTS
NEEDED

• Here's a sign you could place on your air conditioning installation if you use AIR-MAZE air filters. AIR-MAZE panels are scientifically designed and built to last as long as the air conditioning systems in which they are used. And during their long life they continue to give dependable, *trouble-free* performance with a tested air filtering efficiency of 99.3% to 99.83%.

Cleaning and "charging" are simple, economical operations. After each inexpensive servicing the filters are again like new—saving you the expense of costly replacements.

The scientific AIR-MAZE design with its unique all-metal element is the secret of the increased efficiency and low operating cost of these permanent filter panels.



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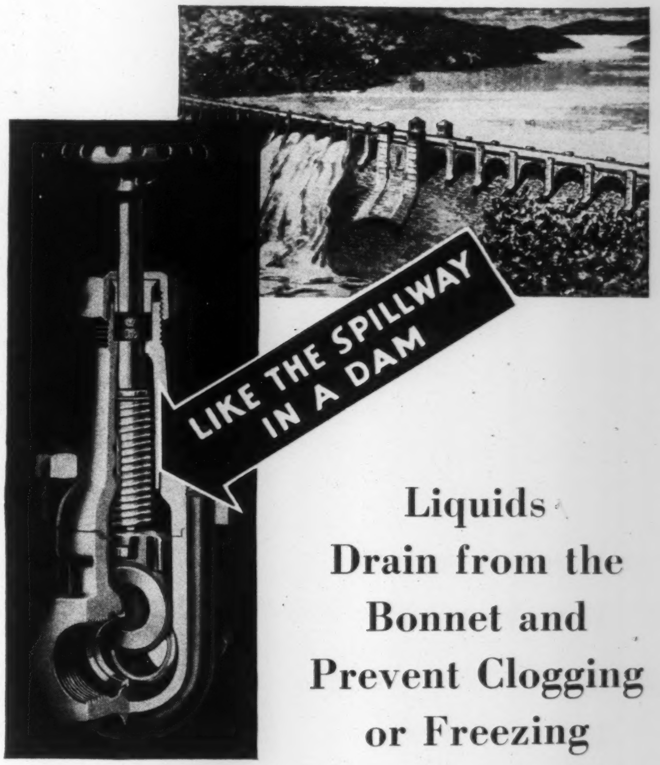
AIR FILTER PANELS



Liquids Drain from the Bonnet and Prevent Clogging or Freezing

Like the spillway in a dam, Fairbanks New U-Bolt Gate Valves have channels in the threaded bushing through which fluids drain back into the body chamber. This prevents clogging or freezing and keeps the stem threads clean.

The long bushing, having more threads, insures easy operation and long wearing service.

The large rugged bronze stem has full cut Acme threads. The knife-edge wedge cuts through sediment and heavy fluids.

The U-Bolt allows the valves to be taken apart and again assembled in minimum time and holds the high-pressure gasket in a perfect joint without leakage.

Stuffing box, being very deep and packed with the best grade of formed asbestos packing, insures a pressure tight seal. It can be repacked with the pressure on when valve is wide open or tight shut.

Body and bonnet are made of high-test alloy iron having an average tensile strength of 40,000 lbs. per sq. in. of sectional area.

Distributors everywhere sell these valves. Try one today. Write for Booklet.

THE FAIRBANKS COMPANY
Valves, Dart Unions, Hand Trucks and Wheelbarrows
Executive Office: 396 Lafayette St., New York, N. Y.
Boston, Pittsburgh—Distributors in Principal Cities
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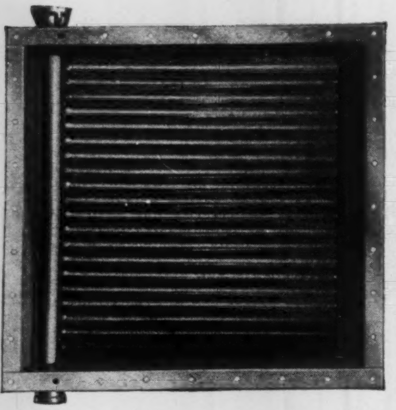
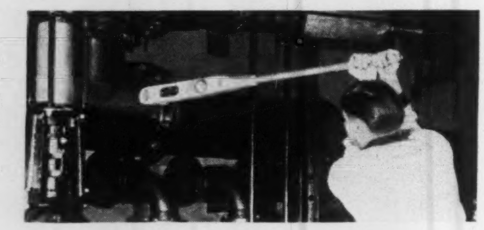
FAIRBANKS
U-BOLT GATE VALVES



These coils are available in two types, the standard in which steam is turned on or off or throttled to obtain temperature control, and the "V. T." type, designed to eliminate possibility of damage due to freezing when steam is alternately turned on or off, or throttled. This latter type has a series of built in air bypasses operated either manually or automatically to control closely temperature of the discharged air stream. It is used for outside air or where inside air is recirculated.—L. J. Wing Mfg. Co., 14th St. and 7th Ave., New York, N. Y.

Tension Indicators

No. 1662—The "Ammco" tension indicator is offered in three models with capacities of 0 to 175 ft-lb (2100 in.-lb), 0 to 420 ft-lb (5040 in.-lb), and 0 to 1000 ft-lb (12,000 in.-lb). The first has a ½ in. square work adapter, the second a ¾ in. square work adapter, and the third a 1 in. square work adapter. Overall lengths are, respectively, 19¼, 33½ and 50 in.



These indicators are for use to definitely show when bolts are tight and not too tight so as to provide uniform tension, prevent distortion of bolted parts and blow-out of gaskets, eliminate leakage, and maintain compression.—Automotive Maintenance Machinery Co., 2100 Commonwealth Ave., North Chicago, Ill.

Booklets, Reports and Papers

Survey of Sulphur Dioxide Pollution

A survey of Sulphur Dioxide Pollution in Chicago and Vicinity, by Alamjit D. Singh, a circular which has just been issued by the engineering experiment station of the University of Illinois, describes a survey of the atmospheric conditions in Chicago and vicinity with respect to pollution with sulphur dioxide, undertaken by the station in coöperation with the smoke inspection and abatement department of the City of Chicago. An article on this survey was published in the October, 1938, HPAC.

In making the survey, the city was divided into seven districts according to the expected intensity capacity for the production of sulphur dioxide, and the importance of the effects. These were as follows: (1) The downtown business district, including the area known as the "Loop" district. (2) Residential districts. (3) Manufacturing areas. (4) Railroad stations and locomotive round houses. (5) Typical outlying residential districts. (6) Typical outlying manufacturing districts. (7) Stock yards.

The results obtained in this survey are presented in the form of tables, and apparently justify the following conclusions, among others:

(a) Approximately 50 per cent of the sulphur dioxide pollution

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NOISY air-conditioning ducts can be annoying . . . and ducts that are not completely fireproofed present a definite hazard. Yet you can avoid both of these dangers . . . assure complete customer satisfaction . . . by installing ducts lined with J-M Airacoustic Sheets.

This modern duct lining absorbs more than 70% of all sounds in the duct. Entirely mineral in composition, Airacoustic Sheets cannot burn or contribute to the spread of fire. And, being highly moisture resistant, they provide maximum protection against damage caused by excessive humidity.

In addition, Airacoustic Sheets are strong and durable, yet light in weight. Easy to apply and handle, they make good-sized reductions in installation costs. For full details, write Johns-Manville, 22 East 40th St., New York, N. Y.

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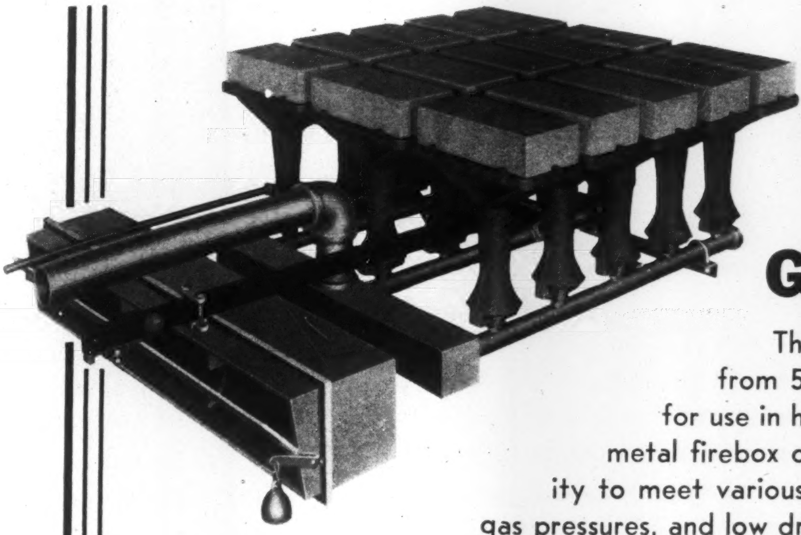

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SERIES F600

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Modern Restaurants use

TRADE **FRICK** MARK

The ultimate in economical air conditioning for restaurants, stores, offices, industrial plants, etc.—built for heavy duty, offers all elements of a central plant when ducts are added: slow-speed refrigerating plant with extra capacity: water cooled motor and machine compartment.

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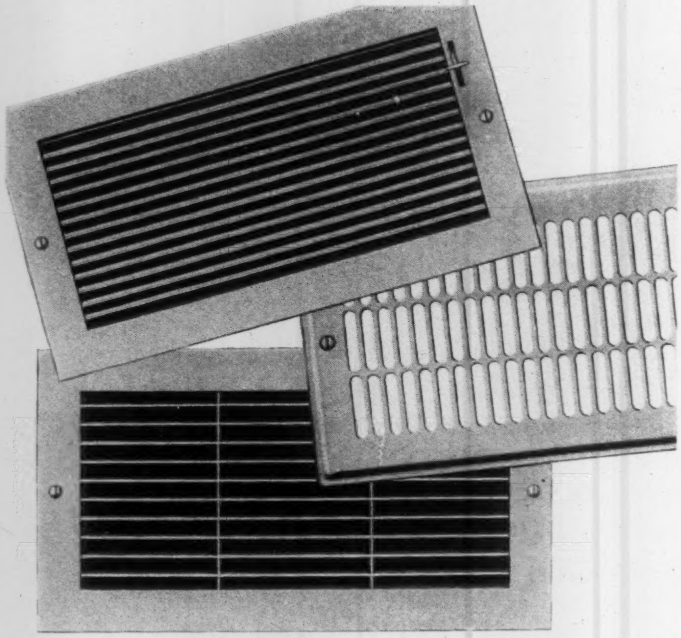

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THE AUER REGISTER COMPANY
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AUER REGISTERS
& GRILLES
For Air Conditioning *and* Gravity

in the downtown business district originated in the district itself, or in sources located in the immediate vicinity.

(b) Residential districts in the north, northwest, and extreme south had the lowest concentrations of sulphur dioxide.

(c) Low chimneys, whether domestic or industrial, discharging gases resulting from the combustion of high sulphur fuels, contributed the major portion of the pollution.

Until September 15, or until the supply available for free distribution is exhausted, copies of Circular No. 36 may be obtained without charge upon application to the Engineering Experiment Station, Urbana, Illinois.

Indexed List of American Standards

The American Standards Association, 29 W. 39th St., New York, N. Y., recently issued an Indexed List of American Standards. The list, a 12 page, 7¾x10½ in. booklet, shows the standards according to subjects and gives their prices.

Under the procedure of the ASA, which serves as a national clearing house for standardization work, more than 600 trade, technical, and government groups are taking part in standardization activities.

Air Conditioning for Tobacco Growers

Adoption of air conditioning by tobacco growers as a means of improving the quality of tobacco leaves and reducing the cost of curing and drying processes was proposed in a talk before the American Chemical Society by Prof. Albert H. Cooper of Virginia Polytechnic Institute. He described a new air conditioning technique which promises to bring substantial economies to the tobacco growing industry. "Today no definite rules are followed in the curing process," Professor Cooper asserted. "Each grower employs certain procedures handed down by his predecessors, altered to suit his own ideas. Consequently, great losses of tobacco occur each year because of inefficient methods."

Using carefully controlled temperatures, humidities, and air velocities, this investigator determined that certain optimum air conditions for each of the several stages of drying and curing the tobacco leaf would take the guesswork out of present practices. To make air conditioning practical for all growers in a given territory, he suggested that the curing be done in large cooperatively operated air conditioned buildings, larger than present tobacco barns and readily accessible to growers by motor truck.

Advantages claimed for the new method are (1) a 50 to 60 per cent reduction in time of curing and drying, (2) uniform quality of tobacco without appreciable loss, (3) elimination of stem greenness, which often ruins tobacco, (4) considerable reduction in labor and fuel requirements, (5) increased capacity of barns as a result of shortened processing time, and (6) reduction of fire hazards.

In the manufacturing divisions of the tobacco industry, air conditioning has for many years been accepted as almost indispensable, William B. Henderson, executive vice-president of the Air Conditioning Manufacturers' Association, points out. "Long before air conditioning was common in theaters, restaurants, stores, and offices, cigar and cigarette manufacturers had air conditioned their plants in order to secure more uniform quality of product and to maintain production schedules. Because tobacco leaves are unusually susceptible to changes in air temperature and humidity, it is logical that the benefits of 'artificial' weather, through air conditioning, can profitably be extended from the manufacturer to the grower of tobacco."

Prevention of Silicosis

A paper on the prevention of silicosis by metallic aluminum, by J. J. Denny, metallurgical engineer, W. D. Robson, chief surgeon, McIntyre Mine, Schumacher, Ont., and Dudley A. Irwin, associate professor, department of medical research, University of Toronto, was published in the Canadian Medical Association

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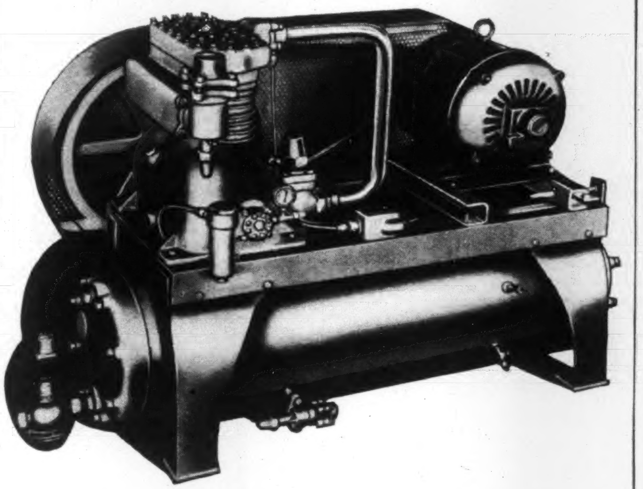

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HEATING and VENTILATING CONTRACTORS receive our cooperation, not competition, as we do not compete with them on any job. Our condensing units are available to them through the leading quality manufacturers of refrigerating and air conditioning equipment.

An inquiry from you will bring data on our complete line of compressors and condensing units.

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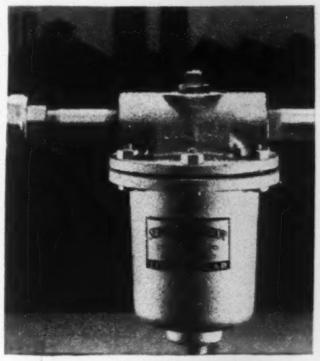

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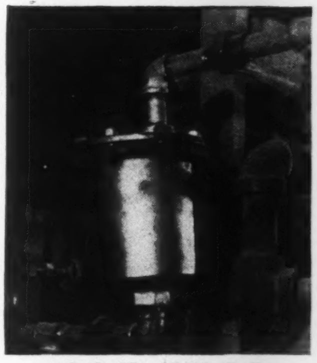

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● Both Winding Road and Air Line take you from point to point—but that's all they have in common. The airplane wastes no time—takes no unnecessary turns—but goes straight to its destination. So too, Anderson Super-Silvertops, the modern, engineered steam traps go straight to the point in steam trap piping. They simplify piping, save fittings and installation time.

Built primarily to be top quality, long life traps, they bring you as a bonus five extra features at no additional cost. These bonus features are (1) simplified piping (a choice of elbow or straight-in-line) (2) extra capacity (106% greater than previous models), (3) guided bucket which increases bucket life and permits larger valve orifice, (4) needs no strainer, (5) ease of inspection (taken apart without disturbing pipe connections).

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Sylphon Thermostatic Water Mixers effectively limit the maximum temperature of hot water delivered to bathrooms, gang showers and kitchens, below the scalding point regardless of storage tank temperatures.

Utilizing hot water from any usual source, they regulate the amount of cold water required to temper the hot to the desired degree, actually mixing the two together before delivery.

Uneffected by sudden fluctuations in temperature or pressure of supply water, they assure accurate maintenance of safe temperatures, protect porcelain and plumbing fixtures. They not only save hot water but effect increased capacity of storage tanks by permitting water to be stored at higher temperatures.

The complete line ranging from sizes for individual showers to sizes for entire sections of large residential, commercial and industrial buildings, is described in bulletin XE 40. Ask for it.

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THE FULTON SYLPHON CO.
KNOXVILLE, TENNESSEE
Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England

Journal, 40, 213-228, 1939. It is a second paper on these studies, the preliminary paper having been published in the same journal in 1937.

The work has indicated that metallic aluminum on being converted into hydrated alumina reduces the toxicity of quartz in tissues in three ways. Studies were made on animals, and no animals whose lungs on analysis contained 1 per cent or more of metallic aluminum showed any evidence of silicosis up to periods of 17½ months, in contrast to well developed silicosis in the quartz control animals in seven months.

The authors state that to prevent silicosis, aluminum dust may be inhaled independently of the silicious dust and that the aluminum dust must be sufficiently concentrated in the inhaled dust to provide a minimum concentration in the lungs of 1 per cent at all times. In discussing the industrial application of the idea, the authors state that aluminum dust in any concentration necessary to prevent silicosis is hundreds of times below the explosive concentration of aluminum powder.

Mobile Air Conditioning

Trends in mobile air conditioning was the subject of a paper presented by R. E. Gould, Frigidaire Div., General Motors Corp., before the annual meeting of the Society of Automotive Engineers in January. In stressing the fact that railroad air conditioning has passed the stage of public acceptance and is now demanded by the public, he mentioned an incident that occurred in a large eastern railroad terminal last summer when an entire trainload of passengers refused to enter a train scheduled to leave in 10 minutes because the particular cars were not air conditioned. Frantic substitution of more modern equipment had to be resorted to in order to relieve the situation.

Mr. Gould said that of the 11,000 existing air conditioned cars, about one-third of them use ice, about 12 per cent the steam jet system, and the remaining some form of vapor compression system involving the use of a mechanical compressor. He stated that the maximum rate of ice meltage for the ice-using cars is approximately 7 tons of ice per 24 hr, the steam jet system requires about 270 lb per hr of 50 lb steam per car and about 80 lb per hr of auxiliary spray water, and that the maximum demand of the mechanical jobs is 14 hp per car and up to 8000 cfm of outdoor air, depending upon the type of condenser used.

Mr. Gould concluded by discussing and showing illustrations of bus air conditioning systems. He said that the demand has grown so quickly that by this coming summer there probably will be between 300 and 400 of these air conditioned vehicles on the highway. The capacity of bus systems is around 3½ tons, he stated.

Conventions and Expositions

Building Industry Week: Second week in May, Chicago, Ill., under auspices of Chicago Building Congress.

National Fire Protection Association: Annual meeting, May 8-12, Stevens Hotel, Chicago, Ill. Secretary-Treasurer, Franklin H. Wentworth, 60 Batterymarch St., Boston, Mass. Papers to be presented include Inspection of Air Conditioning Installation and Maintenance of Systems, by J. T. W. Babcock; Determination of Friction Loss in Fire Hose, by O. L. Robinson; and committee reports on dust explosion hazards; hydrants, valves and pipe fittings; fire pumps; automatic sprinklers; and blower systems.

Acoustical Society of America: 10th anniversary meeting, May 15-16, Hotel Pennsylvania, New York, N. Y. Headquarters Office, American Institute of Physics, 175 Fifth Ave., New York, N. Y.

American Society of Refrigerating Engineers: Spring meeting, May 21-23, Hotel Hershey, Hershey, Pa. Headquarters office, 37 W. 39th St., New York, N. Y. Papers to be presented

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There's too much at stake to gamble on the choice of a water cooler. A bad guess may mean the loss of expensive freon, damage to compressors, costly repairs and delays in the acceptance of the installation.

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Into each Patterson Freon Cooler goes 58 years of experience in the manufacture of heat transfer equipment. Every Patterson Freon Cooler undergoes severe tests so no leakage can develop in service. There has never been a Patterson Freon Cooler that failed to deliver its rated capacity.

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UNDERGROUND steam conduit *must* hold its shape, have permanent structural stability, to retain its efficiency. Interlocking construction, lengthwise and sidewise, enables Ric-wiL Systems to do this. Insulation also must hold its shape—not slump away from pipes. Dry-paC does just that, as numerous tests have proved. If you want your conduit permanently *streamlined* for star performance—get genuine Ric-wiL and genuine Dry-paC!

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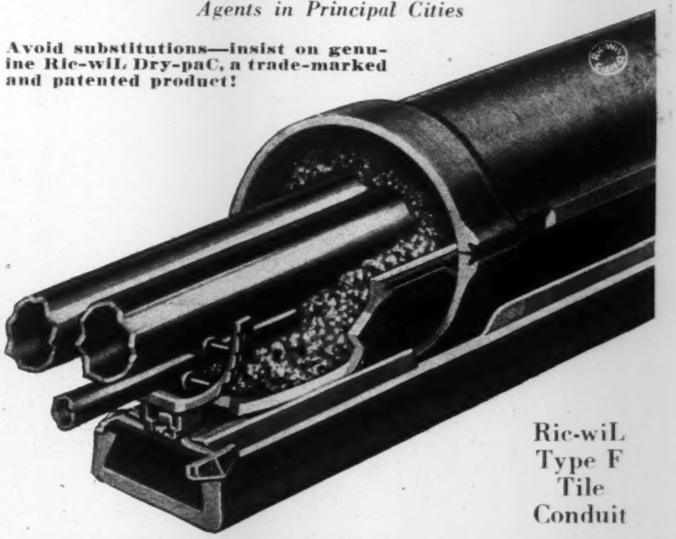
Avoid substitutions—insist on genuine Ric-wiL Dry-paC, a trade-marked and patented product!



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CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

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You can be on the safe side with bearings! Just specify Randall Pillow Blocks for your units. Users get consistently good service year after year, with little attention. Trouble proof. Fool proof. Long lived. Try them and learn the advantages to your customers. Write for catalog and full information.

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Sealing rotating shaft against pressure and vacuum.

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include Methyl Chloride Properties and Tables, by E. W. McGovern; Portable Calorimeter for Small Compressors, by D. D. Wile; Tests on Air Circulation in Precooling, by F. C. Lindvall; Air Conditioning in Government Buildings in Washington, by Charles A. Peters; Bus Air Conditioning, by A. J. Mallinckrodt and Lars Hanson; and a conference on piping practice.

National Purchasing Agents Association: "Inform-A-Show," May 22-25, Fairmont Hotel, San Francisco, Calif.

Association of Gas Appliance and Equipment Manufacturers: Annual convention, May 24-26, Roosevelt Hotel, New York, N. Y. Headquarters office, 60 E. 42nd St., New York, N. Y.

Heating, Piping and Air Conditioning Contractors National Association: 50th annual convention, May 31-June 2, Drake Hotel, Chicago, Ill. Headquarters office, 1250 Sixth Ave., New York, N. Y. Important subjects to be discussed include the apprenticeship program; pipe welding and training and testing welders; the trade promotion program; and the extension and further development of the certification program.

Stoker Manufacturers Association: Annual convention, June 1-2, French Lick Springs, Ind. Headquarters Office, 307 N. Michigan Ave., Chicago, Ill.

National Warm Air Heating and Air Conditioning Association: Mid-year meeting, June 5-7, Stevens Hotel, Chicago, Ill. Headquarters Office, 5 E. Long St., Columbus, Ohio.

American Association of Industrial Physicians and Surgeons with American Conference on Occupational Diseases and Industrial Hygiene: Annual meeting, June 5-8, Hotel Statler, Cleveland, Ohio. Convention manager, Armour G. Park, 540 N. Michigan Ave., Chicago, Ill. Papers to be presented include Health of Workers, by Dr. R. R. Sayers; Fatigue in Industry, by Dr. D. B. Dill; Air Sampling of Asbestos Dust, by J. W. Fehnel; Silicosis in the Silica Brick Industry, by W. B. Fulton, and A. E. Dooley; Apparatus and Procedure for Vapor Toxicity Studies, by D. D. Irish; Exposure to Fluorine in Industry, by W. F. Machle; and Vapor Tension Method for the Determination of Solvents in Air, by L. Silverman and G. Reece.

American Pulp and Paper Mill Superintendents Association: Annual convention and exhibition, June 13-15, Wardman Park Hotel, Washington, D. C. Convention Manager, G. W. Craigie, 176 Mason St., Cumberland Mills, Me.

Smoke Prevention Association: Annual convention, June 13-16, Hotel Schroeder, Milwaukee, Wis. Headquarters office, 139 N. Clark St., Chicago, Ill. Papers to be presented include Conditions That Influence Production of Smoke and Fly Ash Nuisance in the Operation of Underfeed Stokers, by B. M. Guthrie; and a report on the field survey of combustion space requirements for bituminous coal fired underfeed stokers, by Ralph A. Sherman.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 134. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 3128. AIR CONDITIONERS: Carrier Corp., 302 S. Geddes St., Syracuse, N. Y. 4 p. bulletin illustrating and describing two new room air conditioners, one for large rooms and the other for small ones.

No. 3129. AIR CONDITIONERS: Hydro-Kool Systems, 1414 S. Michigan Ave., Chicago, Ill. Leaflet illustrating and describing two sizes of window type air conditioners for offices and homes.

No. 3130. AIR CONDITIONERS: York Ice Machinery Corp., Roosevelt Ave., York, Pa. 16 p. bulletin (39473) on

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Fluid-Air Engineering Co., 311 W. Douglas St., Wichita, Kans.
F. H. Langsenkamp & Co., 229-237 E. South St., Indianapolis, Ind.
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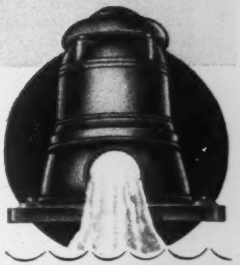

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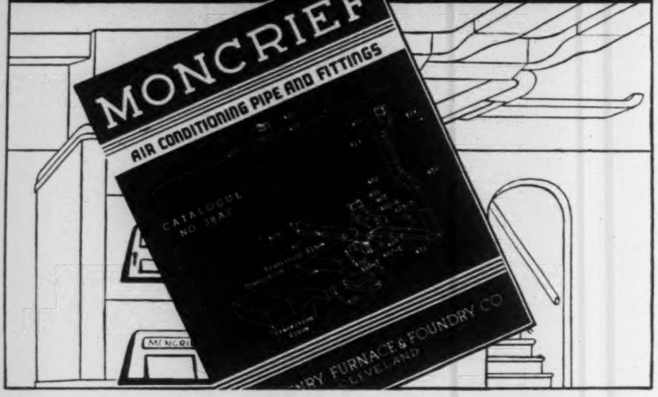
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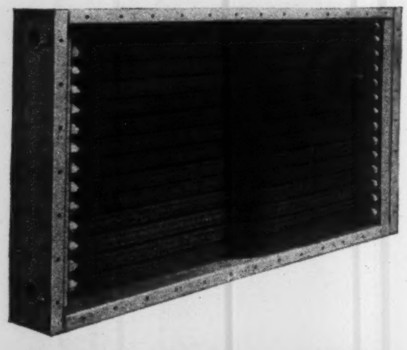

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No. 3131. AIR CONDITIONING: Trane Co., La Crosse, Wis. 28 p. bulletin (S400) on air conditioning for comfort, featuring descriptions and illustrations of numerous installations in hotels, apartments, restaurants, theaters, office buildings, shops, factories, radio studios, hospitals, etc. Air conditioners of various types, compressors, evaporative condensers and coils are described and illustrated.

No. 3132. ALLOY PRODUCTS: Haynes Stellite Co., 205 E. 42nd St., New York, N. Y. 16 p. bulletin giving tables of the physical, mechanical and chemical properties of alloy products and a brief description of each, including "Stellite" cobalt-chromium-tungsten alloys for wear resistance, "Hascrome" chromium-manganese-iron hard facing rod, and "Hastelloy" alloys for resistance to chemical corrosion.

No. 3133. AMMONIA MACHINES: Frick Co., Waynesboro, Pa. 28 p. bulletin (131-H) giving instructions for operating larger ammonia machines with discussions of principles of refrigeration, installation, testing and charging, operating characteristics, and including many illustrations and engineering data.

No. 3134. BOILER GASKETS: Goetze Gasket & Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J. Bulletin and price list illustrating two types of gaskets for manholes, handholes, and tube caps of standard makes of boilers.

No. 3135. BOOSTER FOR PUMPS: Albe Pump Corp., 8 Berry St., Brooklyn, N. Y. Circular illustrating booster which, applied with a pump, may be used for deep well service, including a selection chart for various depths of water in the well and corresponding shallow well pump capacity required.

No. 3136. COMPRESSORS: Ingersoll-Rand Co., 11 Broadway, New York, N. Y. 28 p. bulletin on heavy duty compressors in sizes from 5 to 125 hp, designed to run at moderate speeds and built for heavy continuous service for compression of air and gases on such services as refrigeration, vacuum, high pressure and steam booster.

No. 3137. COMPRESSORS: Worthington Pump and Machinery Corp., Carbondale Div., Harrison, N. J. 6 p. bulletin (C-1100-B2) on horizontal duplex type single stage and two stage refrigeration compressors, describing and illustrating construction features and details.

No. 3138. DIESEL ENGINES: Worthington Pump & Machinery Corp., Harrison, N. J. 8 p. bulletin (S-500-B36) on vertical, four cycle, direct injection, totally enclosed diesel engines, describing, illustrating and diagramming features of construction and giving dimension data.

No. 3139. DUST COLLECTORS: American Foundry Equipment Co., 619 S. Byrkit St., Mishawaka, Ind. 4 p. bulletin on assembled type "Dustube" dust collectors, describing features, giving specifications and showing typical installations. Incorporating same basic principles of design as the large knocked-down type "Dustube" collectors, these units are recommended where relatively small volumes of air are to be handled.

No. 3140. EXPANSION VALVES: Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y. Issue of "Fedders News" (Vol. 6, No. 2) including an article on testing and servicing of automatic expansion valves.

No. 3141. FANS: Hydro-Kool Systems, 1414 S. Michigan Ave., Chicago, Ill. Leaflet describing and giving specifications for exhaust fans.

No. 3142. FLEXIBLE COUPLINGS: Lovejoy Flexible Coupling Co., 5024 W. Lake St., Chicago, Ill. Looseleaf catalog on flexible couplings, giving information on design, list prices, dimensions and specifications.

No. 3143. FLEXIBLE DRIVE SHAFTS: Mechanics Universal Joint Div., Borg-Warner Corp., Rockford, Ill. 12 p. industrial catalog of flexible drive shafts and roller bearing universal joints for industrial applications, describing features and showing uses. Ratings and dimensions are included.

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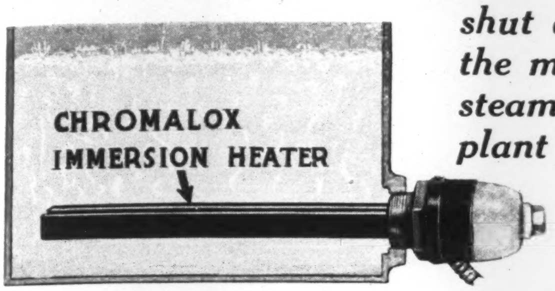

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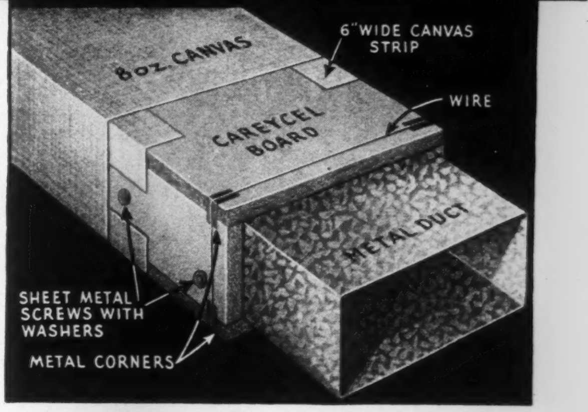

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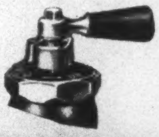

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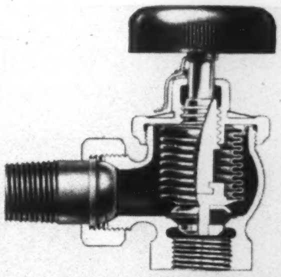

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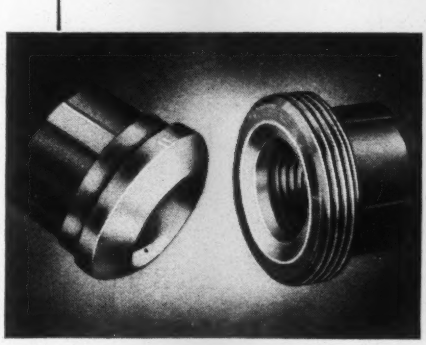

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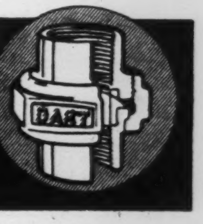

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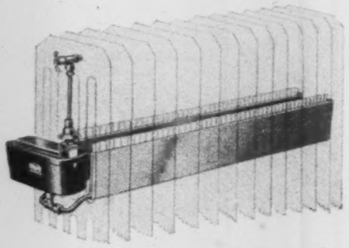

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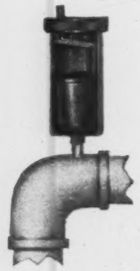

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No. 3144. HEATER SECTIONS: L. J. Wing Mfg. C 14th and 7th Ave., New York, N. Y. 8 p. bulletin (HS-1) o "Featherfin" heating coils or sections for heating or cooling ai available in standard types and in an anti-freeze type for temperature control without throttling steam. A quick selection table i included.

No. 3145. HOT WATER HEATING: Bell & Gossett C 3000 Wallace St., Chicago, Ill. 32 p. bulletin (339) giving information on complete line of equipment for hot water heatin systems, domestic water heating systems, and electrical controls, and featuring a new color code index for quick reference. Th equipment is illustrated and described in detail, and diagrams an tabular data are included.

No. 3146. MONEL: International Nickel Co., Inc., 67 Wall St., New York, N. Y. 12 p. bulletin (T-5) of information o engineering properties of "Monel," including composition, physica constants, strength and ductility, effect of temperatures o strength, corrosion resistance and types of corrosion, workin properties and descriptions of mill products.

No. 3147. PIPE SUPPORTS AND ALIGNMEN GUIDES: American District Steam Co., Bryant St., Nort Tonawanda, N. Y. 6 p. bulletin (35-70B) on "Adsco" pipe supports, saddle plates, pipe alignment guides and pipe anchors f steam or hot water lines.

No. 3148. POWER TRANSMISSION EQUIPMENT: Teuscher Pulley & Belting Co., 801 N. Second St., St. Louis, Mo. 52 p. 1939 catalog on power transmission items includin belting, drives, pulleys, couplings, sheaves, etc.

No. 3149. PUMPS: Worthington Pump & Machinery Corp., Harrison, N. J. 4 p. bulletin (W-321-B13) on turbine drive "Monobloc" centrifugal pumps for use where there is a fire and explosion risk from chemicals, gasoline, dust, oil or gases.

No. 3150. RECORDING THERMOMETERS: Wheelco Instruments Co., 1929 S. Halsted St., Chicago, Ill. Data sheet illustrating and describing recording thermometers for industrial use from 0 to 1000 F.

No. 3151. REFRIGERATION PIPING: National Tub Co., Frick Bldg., Pittsburgh, Pa. 48 p. bulletin (5) giving complete engineering and installation information on refrigeratin piping and comprising principally a technical section which includes data on pipe weights and dimensions, external and internal properties, threading data, refrigeration processes, condensers and capacities, methods of applying refrigerants, piping for general storage, properties of calcium brine and of refrigerants, temperature conversions, and pipe bends. A supplement on corrosion is devoted to methods of retarding corrosion in refrigerating plants.

No. 3152. REGISTERS AND GRILLES: Independent Register Co., 3747 E. 93rd St., Cleveland, Ohio. 48 p. catalog (39AC) giving complete information, illustrations and application data on a line of air conditioning registers and grilles available in a wide range of sizes, styles and types. An illustrated location chart and index facilitates its use.

No. 3153. SHEAVES: Allis-Chalmers Mfg. Co., Milwaukee, Wis. 16 p. bulletin (1261-B) on "Vari-Pitch Texrope" sheaves, illustrating and describing the stationary control type fo occasional speed changes, and the motion control type for use where frequent speed changes are necessary.

No. 3154. SPEED TRANSMISSIONS: Ideal Commutato Dresser Co., 1096 Park Ave., Sycamore, Ill. 4 p. folder describing "Select-O-Speed" transmissions that have handwheel control for fine speed adjustments and where small increments of speed are necessary. Available in sizes from 1½ to 7½ hp.

No. 3155. STEAM TRAPS: W. H. Nicholson & Co., 1 Oregon St., Wilkes-Barre, Pa. 8 p. bulletin (439) on industrial traps, illustrating and describing the various types and givin information on applications, dimensions, and list prices an capacity. Piping diagrams are shown.

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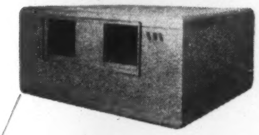

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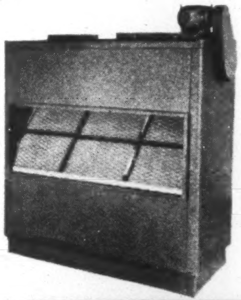

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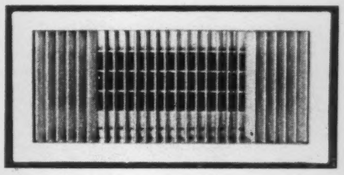

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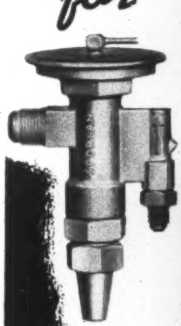

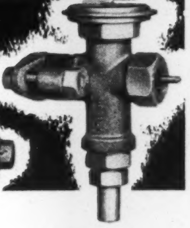

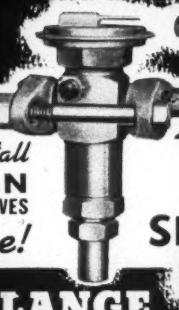

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1653 1654 1655 1656 1657 1658 1659
1660 1661 1662
3128 3129 3130 3131 3132 3133 3134
3135 3136 3137 3138 3139 3140 3141
3142 3143 3144 3145 3146 3147 3148
3149 3150 3151 3152 3153 3154 3155
3156 3157 3158 3159

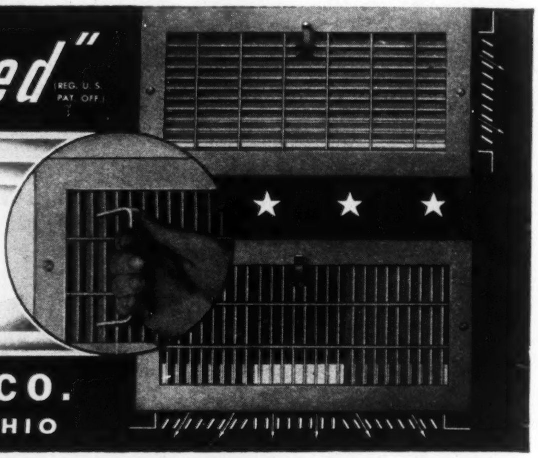
Name .... Title..........
Company ....
Address ....
City .... State..........

No. 3156. UNIT HEATERS: Hydro-Kool Systems, [illegible] S. Michigan Ave., Chicago, Ill. Data sheet illustrating, describing and giving capacity table for suspended type unit heaters.

No. 3157. VALVES: Edward Valve & Mfg. Co., Inc., [illegible] W. 145th St., East Chicago, Ind. Issue of "Valve Values" dated March, 1939, featuring a story on measuring valve parts and discussing equipment methods and problems connected with their inspection.

No. 3158. VALVES, FITTINGS AND ACCESSORIES: Kerotest Mfg. Co., 2525 Liberty Ave., Pittsburgh, Pa. 32 p. catalog (9) on refrigeration and air conditioning valves, fittings and accessories with the many types carefully illustrated and described, and including a complete index.

No. 3159. WELDED FLOATS: W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa. 4 p. bulletin (339) on stainless steel and chromium plated steel welded floats available in spherical and elliptical shapes in diameters from 2½ to 14 in.



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No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-615.

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YARWAY

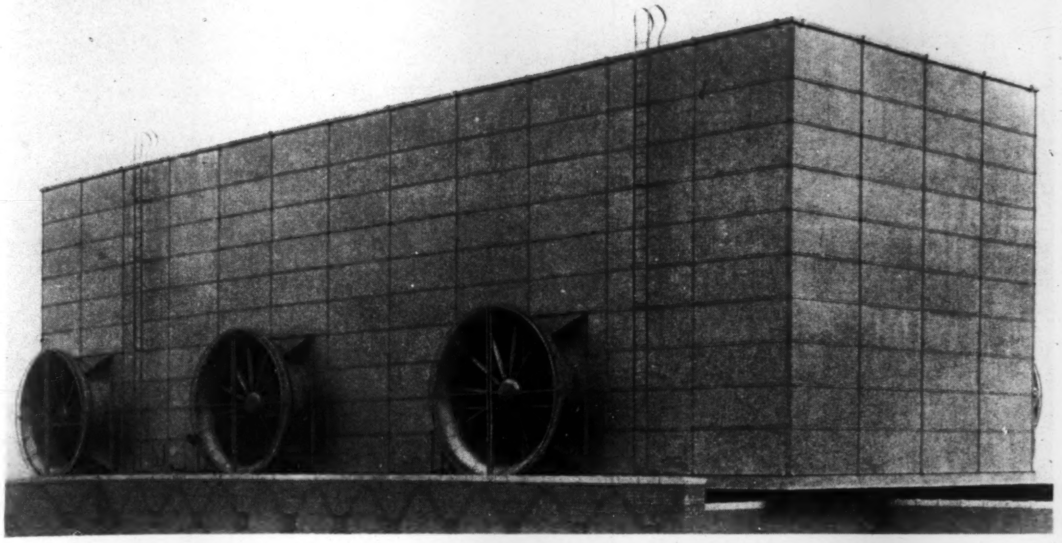
INDUSTRIAL AIR CONDITIONING PRACTICE

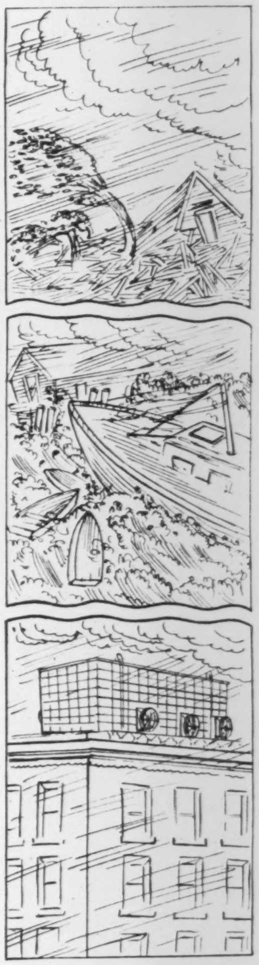
"INDUSTRIAL AIR CONDITIONING PRACTICE"

324 Pages—$2.50

A comprehensive treatment of the profitable application of air conditioning in manufacturing processes. Fully describes air conditioning systems operating today in 14 different types of industrial plants. Every engineer, contractor, and salesman interested in this field of air conditioning should own a copy. Remit $2.50 with order.

KEENEY PUB. CO., 6 N. MICHIGAN AVE., CHICAGO





The complete air conditioning system for the G. Fox & Co. Department Store is one of the largest and most noteworthy in New England. The unusual functions of the cooling tower are particularly interesting. The cooled water is used first to condense the refrigerating gases. It then passes through steam condensers serving the turbine drives of the refrigerating compressors and the turbines driving the electric generating equipment which produces current for the operation of fans, pumps and other machinery comprising the air conditioning system. The tower has a capacity of 10,700 G.P.M.

EDWARD E. ASHLEY
Consulting Engineer
New York

When the HURRICANE Swept New England This MARLEY FORCED-DRAFT COOLING TOWER

Proved Its Strength Equal to Its Efficiency and Economy of Operation

Surmounting the new G. Fox & Co. Department Store, a landmark in Hartford, Connecticut, this Marley steel forced-draft tower felt the full force of last September's hurricane which established new high wind velocities for that vicinity and caused untold property damage. Despite ample evidence of the terrific destructive force of the wind at the top of this tall building, the tower withstood it unharmed. It takes this kind of rugged strength to match the Marley reputation for performance and economy—in all kinds of climatic conditions, in all sections of the country, in all sizes of plants, in all phases of business and industry.

MARLEY—the *Complete* Line of Water Cooling Equipment

The MARLEY Company

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NEW YORK • CINCINNATI • ATLANTA • TULSA
and Exclusive Representatives in Other Principal U. S. Cities, Canada and Cuba

• Mechanical Draft Cooling Towers • • Deck-Type Spray Cooling Towers • • Spray Ponds • Spray-Coil Towers • Atmospheric Spray Cooling Towers • Atmospheric Heat Exchangers and the Famous MARLEY Non-Clog Nozzles for Water Cooling, Air Washing, Brine Spraying, Ice Melting and Humidifying

HOWELL Motors *Run Cool!*

The test, shown at left, is conducted with motor operating under full load and speed conditions, and it invariably reveals that HOWELL Motors run MUCH cooler than their rated temperature rise.

Another One of Our Exacting Tests to Make Sure Everything is RIGHT!

Every HOWELL Motor must undergo a temperature rise test, as an assurance of cool motor operation and as a safeguard against the damage which excessive heating can cause.

And in addition, each **HOWELL Motor** is tested **BOTH** for mechanical balance and for quietness, before given the final O.K.

Thus the engineer or contractor, who uses HOWELL Motors on his air conditioning jobs, is taking the UTMOST precaution against any drive trouble whatsoever.

May we send you Bulletin 1126G covering our complete line?

½ to 150 H.P.

HOWELL MOTORS *Make Good on Hard Jobs*

AND QUIET, TOO! *That HOWELL Motors are also quiet-running is an established fact. Our quietness test, one of the most exacting in the industry, is made in a sound-proof laboratory, using an amplifying microphone which registers sound in terms of decibels.*

HOWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN
Representatives In All Principal Cities

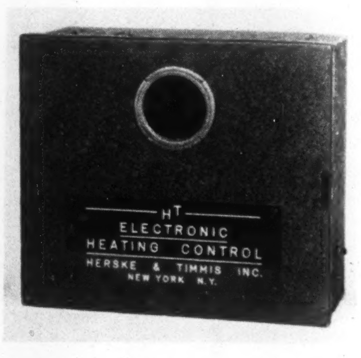
Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 124. Add the new products and companies listed here to your Directory Section which you received in your January, 1939, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double-asterisk (**) equipment and manufacturer not listed

Electronic Heating Control

No. 1663**—The new "HT" automatic heating control illustrated is offered for multi-occupancy buildings with any type of steam heating system fired by oil, stoker or gas. It utilizes radio tubes as a relay element.

The control itself is mounted in a steel cabinet fastened to the wall in the boiler room or wherever desired in the building. The building custodian sets the control dial in accordance with the weather at a point determined by experience to give comfortable temperatures. The control starts the firing device and keeps it on until the pressure switch is satisfied, at which time the firing is stopped. The cut-off point of the pressure switch is set at whatever pressure will cause circulation of steam to all radiators and, according to the maker, this automatically takes into account the response of the firing device and the rate of circulation of the system.

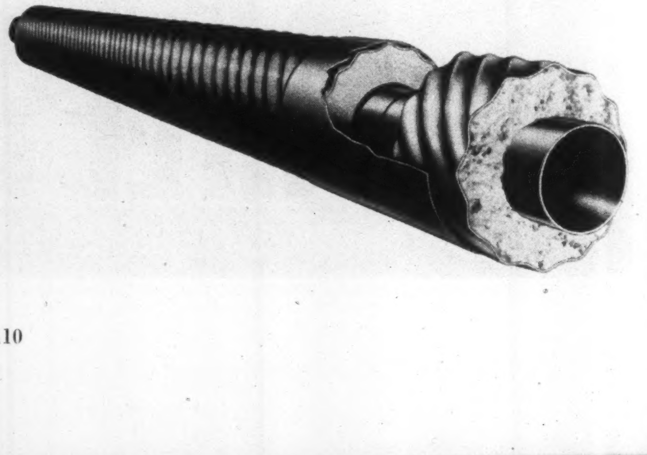


After the pressure switch is satisfied, the control keeps the firing device off for a period determined by the setting of the control dial—the colder the weather, the shorter the off period. A clock switch automatically turns heat off at any desired hour at night and turns it on again to full heat under control of the pressure switch for heating up the building at any desired hour in the morning.

Other new products of the manufacturer include a steel and aluminum convector radiator, a one pipe adjustable diversion hot water system, an orifice system, and other specialties for heating and air conditioning work.—Herske & Timmis, Inc. 33 W. 60th St., New York, N. Y.

Insulated Underground Pipe Units

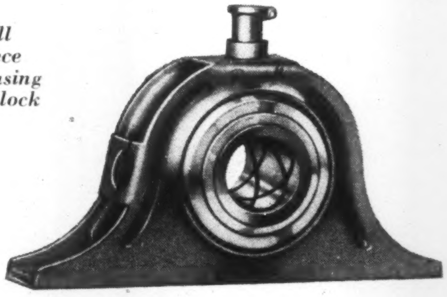
No. 1664—The improved insulated pipe units for underground steam distribution systems illustrated are furnished either in single or multiple types for any kind of steam and return lines. They are available in standard lengths of 20 ft (or special lengths if needed) and include steam pipe, guides and supports for pipe, insulation, conduit housing, and all accessories, includ-



3 things you can depend on with *Randall* pillow blocks

1. Quiet operation with elimination of metallic bearing noises throughout the duct system.
2. Long life operation with little or no attention.
3. Economical in initial cost and installation.

Randall One-Piece Steel Housing Pillow Block



Try Randall Pillow Blocks and learn the value of dependable, trouble-free bearings. Send for new catalog describing the complete Randall line.

●

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177 Lafayette
New York City

American Stock Gear Co.
100 St. Clair Ave., N. W.
Cleveland, Ohio

C. W. Marwedel
San Francisco
California

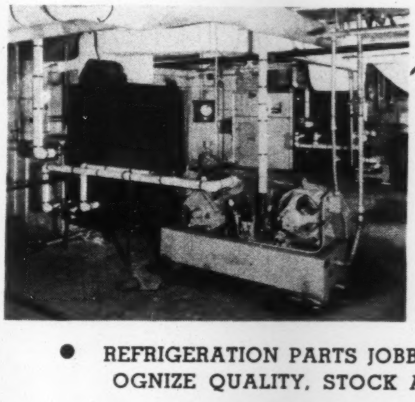
Randall GRAPHITE PRODUCTS CORP.
Dept. 610 609 W. Lake St., Chicago, Ill.

"Coffee and . ." in Year 'Round Comfort at Cleveland Hotel Coffee Shop

"Installed and forgotten"—That's the "label" given to A-P Valves by the men who use them and watch their unusual efficiency on every Air Conditioning and Refrigeration installation. This type of service-satisfaction builds goodwill, not only for owners, like the Cleveland Hotel, but more particularly for the Engineers responsible for these famous installations.

Add . .

A-P Valve reputation to your own—it will mean more profit, less service expense!



A-P Valve Equipped

- Installation — Cleveland Hotel Coffee Shop, Cleveland, Ohio
- Sold and installed by—Avery Engineering Co., Cleveland, Ohio
- Valves—A-P
- Purchased through—Harry Alter Company, Cleveland, Ohio
- Carbondale Equipment used to Air Condition Cleveland Hotel Coffee Shop

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AUTOMATIC PRODUCTS COMPANY
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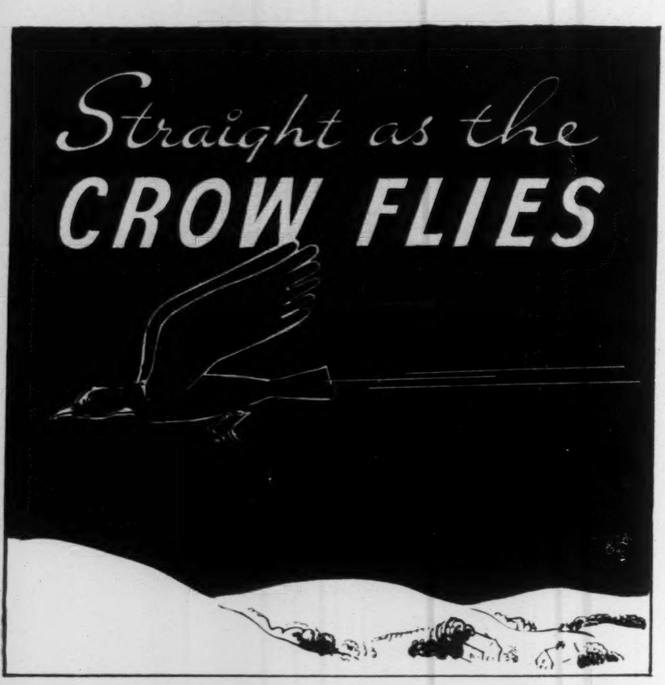
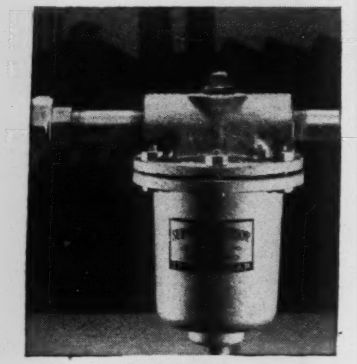
DEPENDABLE
THE BYWORD FOR A-P CONTROLS





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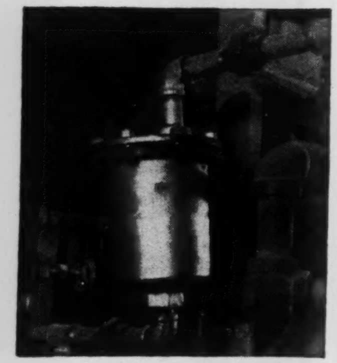


NOT THIS*

● Your steam trap piping is from point to point—straight as the crow flies—with Anderson Super-Silvertop. This *modern* inverted bucket steam trap saves you money by eliminating puzzle-piping—saves the extra time and fittings of puzzle-piping because extra fittings are not necessary with dependable Anderson Super-Silvertops and simplified piping.

Built primarily to be top quality, long life traps, they bring you as a bonus five extra features at no additional cost. These bonus features are (1) simplified piping (a choice of elbow or straight-in-line), (2) extra capacity (106% greater than previous models), (3) guided bucket which increases bucket life and permits larger valve orifice, (4) needs no strainer, (5) ease of inspection (taken apart without disturbing pipe connections).

Send for more information about the steam trap that simplifies your piping—the trap that gives you more for your money. Write to

THE V. D. ANDERSON CO.
1949 West 96th Street • Cleveland, Ohio

*Old Style Anderson Trap

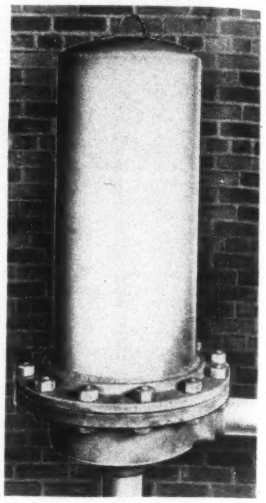
Anderson SUPER-SILVERTOP

ing service connections, and are pre-sealed against water. They arrive on the job ready for welding.

The material used for the conduit housing itself is "Armco Hel-Cor" spirally corrugated heavy gage ingot iron. This outside pipe is galvanized and asphalt coated and is rolled with a water-tight lock seam. The standard insulation is 85 per cent asbestos.

The units are joined in installation by a specially designed connector sleeve also made of "Armco" iron; only shallow trenching is needed to accommodate the units, states the manufacturer.—Ric-wiL Co., 1562 Union Trust Bldg., Cleveland, Ohio.

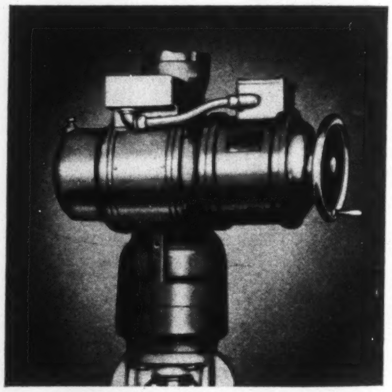
Odor Adsorber for Compressed Air Lines



No. 1665*—The new "Dorex" pipe line odor adsorber is offered for removing odors such as those of oil vapors, fermentation vapors, and other objectionable gases from compressed air lines. It uses activated coconut shell carbon which, according to the manufacturer, will adsorb odors up to 15 to 20 per cent of its weight.

The unit shown has a compressed air capacity of 175 cfm.—W. B. Connor Engineering Corp., Dorex Air Conditioning Div., 114 E. 32nd St., New York, N. Y.

Hydraulic Actuator for Valves



No. 1666—The "Barnes" hydraulic valve actuator is offered as a device for positive opening and closing operations on globe, gate, butterfly, rotary plug valves and many similar applications. According to the maker, the range of capacity is practically unlimited, as standard or special sizes are available for almost any requirement. Open and closed applications and positioning control are available by automatic or manual means and by remote control.

The device provides a positively controlled travel at all times and due to compensating design conforms to changes caused by a variable temperature of the valve proper. It may be installed on existing equipment and is adapted to various makes of valves.—Automatic Temperature Control Co., Inc., 34 E. Logan St., Philadelphia, Pa.

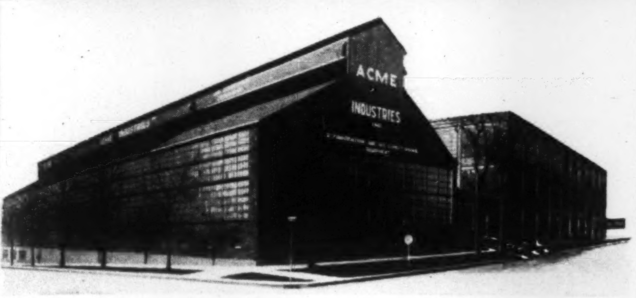
System for Heating Viscous Liquids

No. 1667—The "Lines" thermal electric conduction system for heating viscous liquids permits heating the oil or other liquid from a point inside the tank to the point of use, as temperature is thermostatically controlled throughout the length of the piping.

The system comprises three units. A special transformer applies electrical energy to make the entire piping system a long heating unit so that the liquid entering the piping is continually being heated until it flows to the point of use. The temperature is con-

ACME PRODUCTS

REFRIGERATION AIR CONDITIONING



AIR CONDITIONING EQUIPMENT

It is possible that you are not protecting your own interests if you fail to learn of the advantages presented by the use of

ACME PRODUCTS

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SHELL AND TUBE WATER COOLERS
FLOODED

DRY-EX WATER COOLERS
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SHELL AND TUBE CONDENSERS

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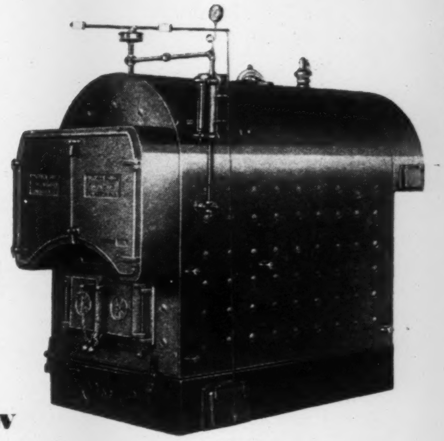
116 BROAD ST., NEW YORK CITY



Hank

Sez–
As How
Sugar And Steel Boilers
Are The Same Thing

After reading that title you're saying, I'm an "eight cylinder liar".

All right, then I am. But saying I am and proving it, are a kupple o' different things.

So let's git down to our sugar. Sugar is sugar, ain't it?

Any one brand is as sweet as any other. Just the same, betcher your wife insists on Jack Frost or some other brand she knows is made right, by the right folks.

In much the same way, steel boilers is mostly steel boilers. All of 'em has to be made up to code standards or specifications.

Still there's a lot of you engineering fellers, who buys by name, same as your wife does. Name's the same as reputation. Burnham has one of 'em. You git the code specification, but what you really buy by, is the Burnham reputation.

You can't make a reputation. You have to build it. It too has its specifications. Burnham's reputation specifications have never changed. They're the same ones they started with over a quarter of a century ago. There's a lot more could say, but ain't a going ter, 'cause 'tain't necessary, being as how you are intelligent.

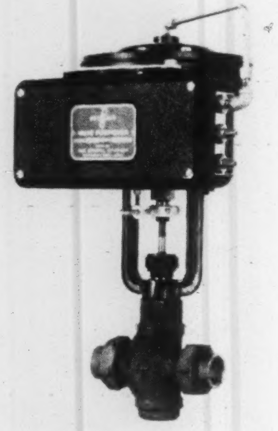
Hank Hindle

BURNHAM BOILER CORPORATION
Distributed Through Wholesalers
IRVINGTON, N. Y. ZANESVILLE, OHIO
Branch Offices in All Principal Cities
Export Department, 50 Church St., N. Y. City

Burnham Boiler

trolled by a thermostat. The third unit is a specially designed tank head, electrically insulated, with outlets for suction and return. This unit screws into a standard tank tapping and is extended with standard steel pipe to the point of suction. It is electrically heated as part of the piping system and utilizes the principle of returning hot oil in close proximity to the incoming cooler oil and refeeding to the burner through the suction line.—Albert G. Purdue Associates, 303 Wooster St., New Haven, Conn.

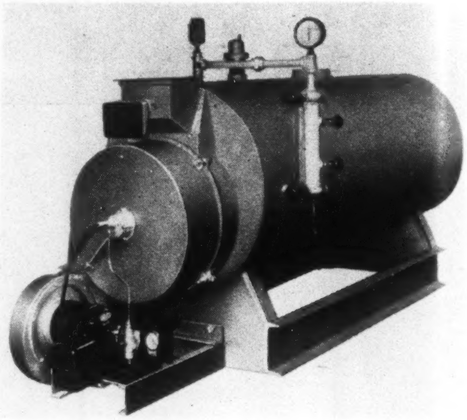
Positioner for Control Valves



No. 1668—A new valve positioner for use on diaphragm control valves has been developed to overcome the effect of friction in the valve stem and top. This pneumatic device is recommended by the maker for use on air operated control installations where close control is of paramount importance and particularly on those where there is considerable process lag.

This valve positioner is designed to assure a proportionate valve stem travel for even a slight change in the pressure of the air from the controller, and to overcome friction that might tend to prevent the valve disc from coming to its intended position in order to maintain close control.—Bristol Co., Platts Bridge, Waterbury, Conn.

Unique Heating Boiler



No. 1669**—A new line of "Cyclotherm" heating boilers in sizes ranging from 25 to 150 hp have been announced; according to the maker they utilize a "cyclonic" principle of combustion and heat transfer. These units have the burners built in and all sizes are available in models firing light fuel oil; the units above 70 hp may be fired with bunker C oil. Ratings range from 3500 to 21,000 sq ft of steam radiation. Units for pressures of 15, 100, 150, 200 and 250 lb are available in all of the six sizes.

The units operate at a positive pressure, the maker states, so that no stack draft is necessary, and where a side vent is permissible or desirable, the unit can be installed without the usual stack connection. No bricking is entailed in the installation as the combustion chamber is a cylindrical tube.

The units may also be had for gas firing.—General Furnaces Corp., 17 State St., New York, N. Y.

Stainless Steel Welding Electrode

No. 1670—A new arc welding electrode of the 18-8 type, hav-

CERTAINLY, WE'VE GOT TO LINE THESE DUCTS...

"FOR QUIET...

We don't want any complaints about noise after this system is installed. We can line the ducts now with Airacoustic Sheets, without adding much to the cost of the job. They soak up more than 70% of all sounds in the duct. What's more, the system needs Airacoustic Sheets . . .

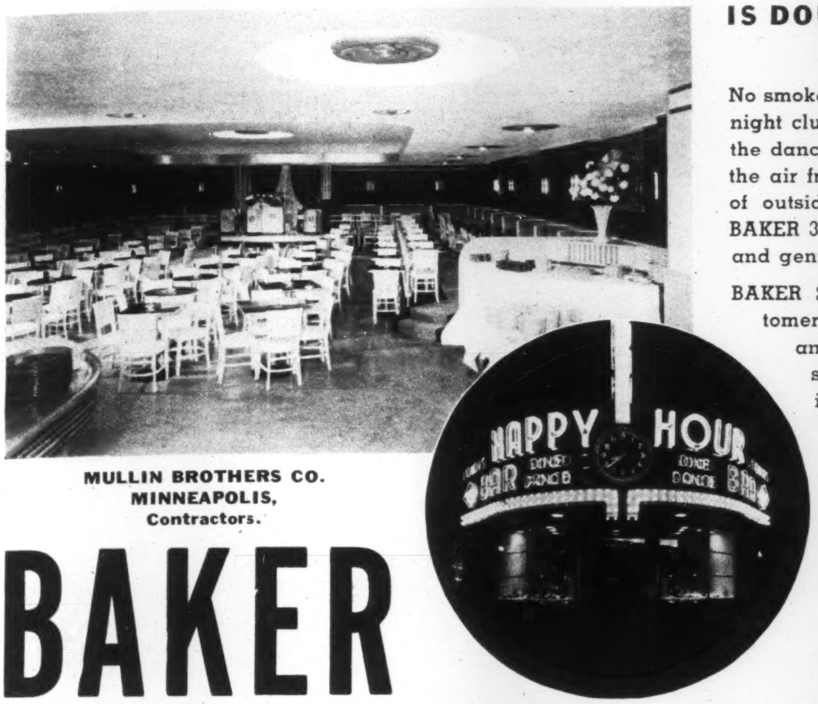
"FOR FIRE-SAFETY...

The National Board of Fire Underwriters has reported too many cases where combustible duct linings have caused serious fire losses. Airacoustic Sheets minimize this risk because they are basically mineral and will not contribute to the spread of fire."

You can use J-M Airacoustic Sheets for lining any type of duct. They are easy and economical to apply. And, once installed, the job is really finished. Humidity offers no costly maintenance problem, for Airacoustic Sheets are exceptionally moisture-resistant. They combine high transverse strength with low heat conductivity. You should have full details. Write Johns-Manville, 22 East 40th Street, New York, N.Y.

JM Johns-Manville AIRACOUSTIC SHEETS FOR DUCT LININGS

Hot Rythms + Cool Comfort



IS DOUBLE ATTRACTION FEATURED BY SMART NIGHT CLUB

No smoke gets in your eyes at the Happy Hour, leading night club in Minneapolis. For no matter how jammed the dance floor, BAKER System Air Conditioning keeps the air fresh as all outdoors. Five thousand cubic feet of outside air per minute are filtered, cooled by a BAKER 30-ton dual condensing unit (heated in winter), and gently circulated throughout the cafe.

BAKER System Refrigeration also contributes to customer comfort by keeping beer and back bar cold and making quantities of ice cubes. Both BAKER systems are designed especially for flexibility in order to provide maximum economy of operation in spite of the varying load. If you have an air conditioning or refrigeration problem, see a BAKER representative or write direct to the factory.

MULLIN BROTHERS CO.
MINNEAPOLIS,
Contractors.

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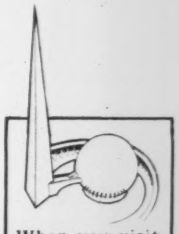
IT'S A "NATURAL" FOR MODERN AIR CONDITIONING INSTALLATIONS

HUSSEY *Pure Lake* COPPER

Fortified and endowed by Nature to ideally withstand the most severe corrosive conditions, Hussey Pure Lake Copper is a "natural" for Air Washers, Blowers, Coils, Ducts, Tanks, and other similar units required in modern air conditioning systems—where permanence of installation and trouble free service are of paramount importance. That is why Hussey Pure Lake Copper enjoys such rating among air conditioning engineers and contractors throughout the industry,—why it always pays to insist on Hussey Pure Lake Copper—the standard of quality for more than 90 years.

C. G. HUSSEY & COMPANY
(Division of Copper Range Co.)
Rolling Mills and General Offices: Pittsburgh, Pa.
Warehouse Stocks in the Principal Cities



When you visit the New York World's Fair be sure to see the Educational Exhibit sponsored by the Copper and Brass Industry in the Metals Building.

Copper **HUSSEY** *Brass*

ing 3½ per cent molybdenum, has been developed for welding the various stainless steels which contain approximately this percentage of molybdenum. Its physical properties are similar to 18-8 stainless steel, says the maker.

A coating is provided on the electrode to prevent oxidation of the weld metal and keep the analysis of the deposited metal virtually the same as the parent metal. The electrode is made in 1/8, 5/32 and 3/16 in. sizes and 11½ in. lengths.—Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

Book Reviews

New Edition of Piping Handbook

["Piping Handbook," by J. H. Walker, Superintendent of Central Heating, The Detroit Edison Co., and Sabin Crocker, Senior Engineer, Engineering Division, The Detroit Edison Co. 3rd ed. 1939. 897+xi pp., 4½x7 in., semi-flexible binding. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y. Price, $6.00.]

The third edition of this handbook on piping design is a worthy successor to its predecessors. While the second edition, which appeared in 1931, differed little from the first edition published in 1930, significant changes in piping practice during the past eight years made imperative a thorough rewriting of the third edition.

Since 1930—the authors point out in their preface—welded joints have come into their own, ready made welding fittings have been invented and have gone into quantity production and use, welding end valves have been developed and adopted, superheated steam temperatures have advanced from 750 to 950 F, weldable alloy steels having adequate strength at temperatures up to 950 F have been developed, new methods of pipe manufacture have been introduced with seams welded by the electric resistance or fusion processes, more dimensional standards and material specifications have been formulated, and the ASA code for pressure piping has been published.

Chapters are included on definitions, formulas and tables; properties of fluids; metallurgy of piping materials; pipe, valves and fittings; heat insulation; hangers and supports; expansion and flexibility; steam power plant piping; building heating systems; plumbing systems; underground steam piping; water supply piping; fire protection piping; and oil piping.

Arc Welding in Design, Manufacture and Construction

["Arc Welding in Design, Manufacture and Construction," comprising 109 papers receiving awards in the recent award program of the James F. Lincoln Arc Welding Foundation. 1939. 1408+xxxii pp., 6x9 in., semi-flexible binding. Published by The James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio. Price, $1.50 in U. S. A., $2.00 elsewhere.]

The heating and piping industries are well represented among the 109 original studies contained in this new book. The containers section of the book, which includes the heating and piping studies, fills 156 of its pages and includes 64 illustrations. The subjects of the 11 chapters in this section are as follows: Oil well casing; thimble tube and watertube boilers; 800,000 gal storage tank; economic type boiler; stationary steel tank; hydraulic turbine scroll cases; steel mill pipe line; penstock of nickel-clad steel; pipe lines for paper board cylinder machine; eliminating flange joints on piping; and modernizing a large brewery with welded piping.

The trustees of the Foundation decided to publish this volume, because they felt the award papers constitute a large and valuable source of scientific study, research and information on welding.

The Completeness of the CURTIS Line Assures the Correct Equipment for Every Air Conditioning or Refrigeration Need

WHETHER you buy, sell, install or specify air conditioning or refrigeration equipment, there's a Curtis unit that fulfills every requirement. Curtis covers a wide range of markets—makes possible greater sales. And you can specify Curtis products with absolute confidence.

The Curtis Store and Office Cooler fulfills the air conditioning demands of all classes of retail establishments. It's a complete, factory designed, packaged air conditioning unit. It mechanically cools, dehumidifies, circulates and filters the air — is quickly and easily installed with only water and electrical connections needed — adaptable for heating, too. It is offered in 3 and 5 ton sizes.

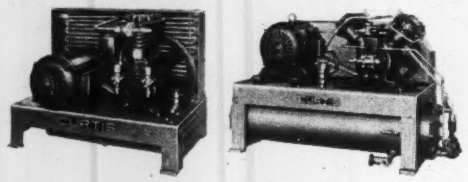
The Curtis Line of Condensing Units includes sizes from 1–6 H. P. to 30 tons air and water cooled — also unit coolers, coils, evaporative condensers, etc. Every Curtis product is precision engineered to deliver economical, efficient, care-free performance throughout an exceptionally long life.

Curtis Refrigerating Machine Company

Division of
Curtis Manufacturing Co.
1950 Kienlen Avenue,
St. Louis, Mo.

CURTIS
REFRIGERATION
AIR CONDITIONING
AND COMMERCIAL

"Builders of Condensing Units Since 1926"



48 Air Cooled Units — 45 Water Cooled Units — 1/6 to 30 H.P.

The Curtis Store and Office Cooler 3 and 5 ton sizes

FULTON
Sylphon
TRADE MARK
FOR
TEMPERATURE
CONTROL

• of Duct Heating and Air Conditioning

Fulton Sylphon offers architects and engineers a line of controls ideally suited to the regulation of duct temperatures in air conditioning and indirect heating and ventilating systems where heating is by steam coils in the ducts, and cooling is by circulated cold water or calcium chloride brine.

Principal reasons for Sylphon preference are: Modulating action of Sylphon controls for maintenance of desired temperatures within extremely close limits; self-contained, self-powered, compact design, easy to install, and requiring no compressed air, no wiring, motors, levers, chains or other auxiliary equipment; patented star-shaped bulbs and coil type bulbs providing unusual sensitivity; dependability of rugged all metal construction from the finest materials available; products of specialists in temperature control for over thirty years.

New Sylphon Bulletins describe the present complete line of Sylphon controls for this and other temperature control services. Ask for your copies.

● Individual Room Temperature Control — Bulletins LE 80 and LE 70 . . . Zone Control — Bulletin LE 70 . . . Space Heat Control in Large Industrial Areas — Bulletins LE 50 and LE 70 . . . Duct Type Heating and Air Conditioning Controls — Bulletin LE 50 . . . Service Hot Water Supply Control — Bulletins LE 20 and LE 40 . . . Drinking Water Temperature Control — Bulletin LE 20.

THE FULTON SYLPHON CO.
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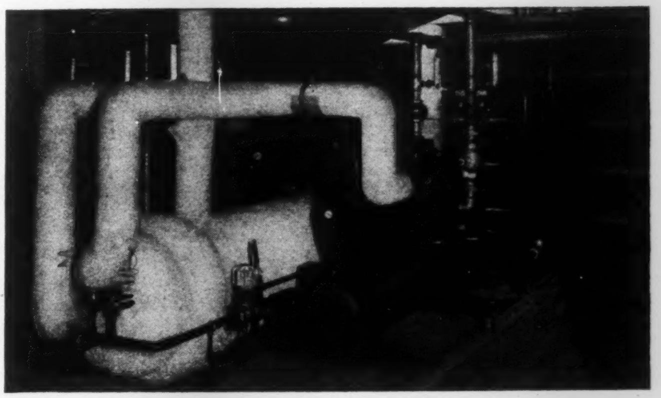

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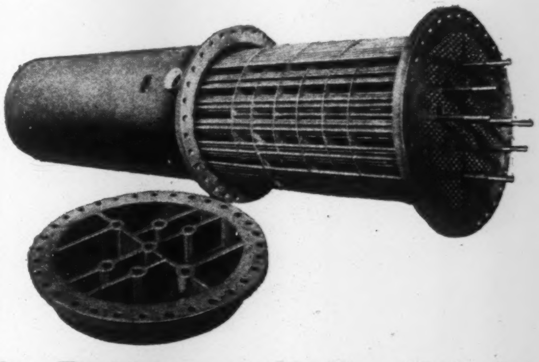

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HPACCNA Engineering Standards

["Heating, Piping and Air Conditioning Contractors National Association Engineering Standards," developed by the committee on standards of the HPACCNA. 3rd ed. 1939. 8½x11 in. pp., loose-leaf binder. Published by the Heating, Piping and Air Conditioning Contractors National Association, 1250 Sixth Ave., New York, N. Y. Price, $5.00.]

The new edition of these well known engineering standards is divided into five parts. Part 1 covers the figuring of radiation of boilers, Part 2 the sizing of boilers, Part 3 is on pipe sizes, Part 4 presents dimensional standards, and Part 5 is a compilation of air conditioning data.

The material follows the format of previous editions and is excellently arranged for everyday use.

Booklets, Reports and Papers

Pipe and Piping Materials Specifications

The American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., has compiled its specifications for pipe and piping materials for high temperature high pressure service in one 135 page publication. The booklet is 6 x 9 in. in size, has a heavy paperboard cover with spiral ring binding and can be obtained from ASTM headquarters at $1.25 per copy.

It brings together in convenient form various standard and tentative specifications for steel piping materials used in high temperature, high pressure services and includes specifications for steel and alloy steel pipe and tubing, castings, forgings, and bolting for central station power plants, and for similar industrial installations of piping materials. In all, 17 specifications are included.

More Refrigerating Machinery Standards

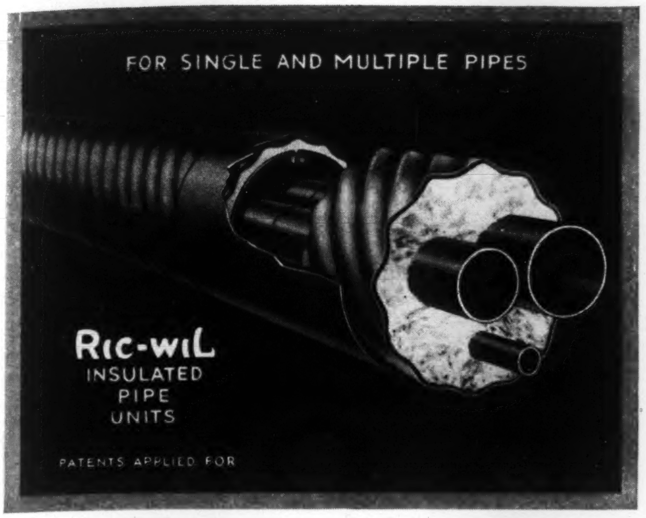
Refrigerating machinery standards supplementing the equipment standards published last year by the Refrigerating Machinery Association, Southern Bldg., Washington, D. C., were announced following the meeting of the association in Hot Springs, Va., last week. Under the title Equipment Standards Supplement "A," the 14 page publication includes base specifications for self contained ammonia units, ammonia brine cooler ratings, "Freon-12" piping data, standard nomenclature for reciprocating compressors, etc. Copies are available from the association's headquarters office, the price for single copies being 25c.

Conventions and Expositions

Air Conditioning Exposition: June 1-10, Commonwealth Edison Co. Assembly Hall, Chicago, Ill.

National Warm Air Heating and Air Conditioning Association: Mid-year meeting, June 5-7, Stevens Hotel, Chicago, Ill. Headquarters Office, 5 E. Long St., Columbus, Ohio.

American Association of Industrial Physicians and Surgeons with American Conference on Occupational Diseases and Industrial Hygiene: Annual meeting, June 5-8, Hotel Statler, Cleveland, Ohio. Convention manager, Armour G. Park, 540 N. Michigan Ave., Chicago, Ill. Papers to be presented include Physiologic Effects of Hot Atmospheres, by F. C. Houghten; Modern Dust Control in Underground Mines, by D. E. Cummings; A Study of Silicosis in the Silica Brick Industry, by W. B. Fulton and A. E. Dooley; Vapor Tension Method for the Determination of Solvents in Air, by L. Silverman and G. Reese; Air Sampling of Asbestos Dust—Comparison of Impinger and Electrostatic Precipitator Methods, by J. W. Fehnel;



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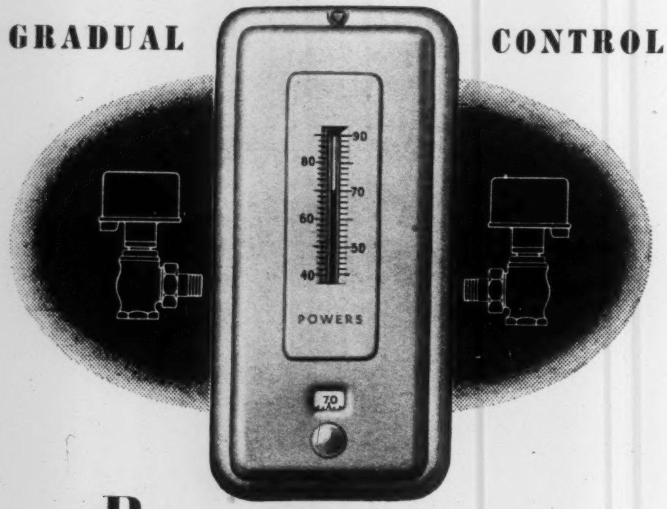

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American Pulp and Paper Mill Superintendents Association: Annual convention and exhibition, June 13-15, Wardman Park Hotel, Washington, D. C. Convention Manager, G. W. Craigie, 176 Mason St., Cumberland Mills, Me.

Smoke Prevention Association: Annual convention, June 13-16, Hotel Schroeder, Milwaukee, Wis. Headquarters office, 139 N. Clark St., Chicago, Ill. Papers to be presented include Instructions in Burning Fuels Smokelessly and Economically, by Ben G. Elliott; Requirements That Should be Incorporated in a Smoke Ordinance, by Chas. W. Gruber; Conditions that Influence Production of Smoke and Fly Ash Nuisance in the Operation of Underfeed Stokers, by E. C. Webb; Preparation and Quality Control of Steam Coals, by Henry F. Hebley; Report on Combustion Space Survey, by Ralph A. Sherman; Properties of Coal That Affect Burning Characteristics, by Wm. A. Pearl; Some Practical Data on Fuel Oil and Its Combustion, by R. G. Bender; Processing Coal into a Smokeless Fuel, by C. E. Lesher; The Smokeless Fuels Research Program of the Illinois State Geological Survey, by M. M. Leighton; Current Developments in Reducing Fly Ash Emission from Chimneys, by J. F. Barkley; Will Efficient Management of Heating Plants Reduce Air Pollution?, by C. E. Beery; and Use of the Ringlemann Chart in Measuring Smoke, by John M. Hodges.

International Acetylene Congress: 13th International Congress of Carbide, Acetylene, Oxy-Acetylene Welding and Allied Industries, June 25-July 1, Munich, Germany. International Acetylene Association, 30 E. 42nd St., New York, N. Y.

American Society for Testing Materials: Annual meeting, June 26-30, Chalfonte-Haddon Hall, Atlantic City, N. J. Headquarters Office, 260 S. Broad St., Philadelphia, Pa.

National District Heating Association: Annual convention, June 27-30, Hotel Pennsylvania, New York, N. Y. Headquarters office, 1317 Spruce St., Philadelphia, Pa.

Food Technology Conference: June 28-July 1, Cambridge, Mass., under auspices of division of food technology and industrial biology, Massachusetts Institute of Technology. Applications for registration cards should be made to Prof. B. E. Proctor, M. I. T., Cambridge, Mass.

American Society of Heating and Ventilating Engineers: Semi-annual meeting, July 4-6, Grand Hotel, Mackinac Island, Mich. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 124. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 3160. AIR CONDITIONERS: Carrier Corp., 302 S. Geddes St., Syracuse, N. Y. 4 p. folder on advantages of room air conditioners for doctors' offices.

No. 3161. AIR CONDITIONING: Frick Co., Waynesboro, Pa. Issue of "The Frick System" (Vol. 10, No. 10) describing installation at National Biscuit Co. theater at New York World's Fair, and other air conditioning installations.

No. 3162. AIR CONDITIONING COILS: Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y. 48 p. bulletin (392) on "All Season" air conditioning coils with application and engineering data, capacity ratings, examples, etc.

No. 3163. AIR CONDITIONING IN KNITTING MILLS: Parks-Cramer Co., 970 Main St., Fitchburg, Mass. Issue of "Parks' Parables" devoted to air conditioning in full-fashioned knitting mills, giving a practical discussion and showing installations.

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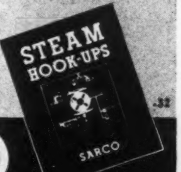

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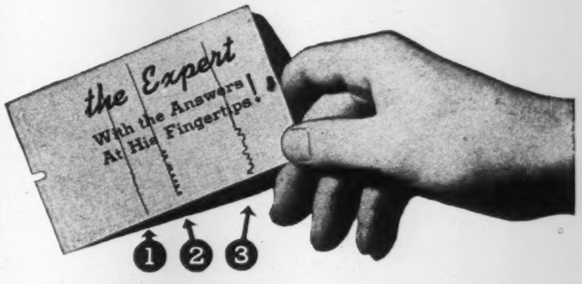
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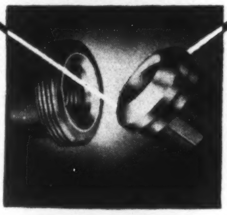

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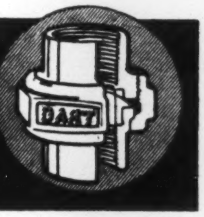

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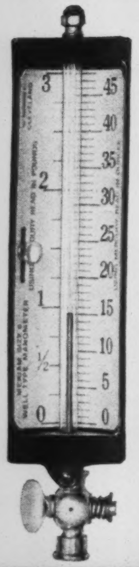

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No. 3164. AIR DIFFUSERS: Anemostat Corp. of America, 10 E. 39th St., New York, N. Y. Mimeographed bulletin on use of high velocity air diffusers in refrigeration work, discussing advantages, presenting temperature readings, giving volume and velocity tables, and including diagrams showing methods of installation.

No. 3165. BACKING RINGS: Midwest Piping & Supply Co., Inc., Second and Barry St., St. Louis, Mo. 8 p. bulletin (38-B) on backing rings for high pressure welded pipe joints, illustrating and describing a design of backing ring which is the result of several years' research and has been confirmed by joint destruction tests.

No. 3166. COMPRESSORS: Worthington Pump and Machinery Corp., Harrison, N. J. 8 p. bulletin (L-611-B8) on compressors, single cylinder, single stage, motor driven and steam driven.

No. 3167. CONDENSING UNITS: Universal Cooler Corp., Green and Melville Aves., Detroit, Mich. 8 p. bulletin illustrating and describing features of construction of condensing units, including cross section views.

No. 3168. CORK: Armstrong Cork Co., 994 Concord St., Lancaster, Pa. Leaflet telling how cork protects investment in air conditioning, with particular reference to insulating ducts and equipment, brine and ammonia lines, and isolating vibrating machinery.

No. 3169. DIE HEADS: Landis Machine Co., Inc., 5th and Church Sts., Waynesboro, Pa. 16 p. bulletin (F-90) on heat treated die heads.

No. 3170. EVAPORATIVE CONDENSERS: Frick Co., Waynesboro, Pa. 4 p. bulletin (234-B) on evaporative condensers for ammonia and "Freon-12" refrigerating systems, with engineering and capacity data.

No. 3171. EYE SHIELDS: Chicago Eye Shield Co., 2300 Warren Blvd., Chicago, Ill. 48 p. catalog on industrial head and eye protection, including goggles, shields, helmets, masks, etc.

No. 3172. FANS: Emerson Electric Mfg. Co., 1847 Washington Ave., St. Louis, Mo. 16 p. catalog (X3359) on exhaust fans, shutters, mesh guards, etc. for commercial, industrial and domestic use.

No. 3173. FANS: L. J. Wing Mfg. Co., 14th St. and 7th Ave., New York, N. Y. 8 p. bulletin (F-7) featuring table for quick selection of fans, and giving a complete listing of "Scruplex" propeller fans with capacities and other data, including acid resisting and dyehouse fans, shutters and penthouses.

No. 3174. FINNED TUBE PRODUCTS: Bush Mfg. Co., 100 Wellington St., Hartford, Conn. 40 p. catalog of finned tube products including walk-in cooler coils, unit coolers for walk-in coolers, circulators, reach-in cooler coils, display case coils, unit coolers, ice making coils and plate coils.

No. 3175. FLEXIBLE METAL TUBING: American Metal Hose Branch, American Brass Co., 67 Jewelry St., Waterbury, Conn. 24 p. bulletin (SS-25) on seamless flexible metal tubing with information on uses for conveying steam, liquids and gases; controlling vibration; connecting misaligned and moving parts; and in product design. Engineering data and specifications are given, with simple installation rules.

No. 3176. FLOW METERS: Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa. 60 p. bulletin (18-R) on "Rotameters" for measuring flow of liquids and gases, including types with glass metering tubes, metal metering tubes and special types, and with a section on application, testing and calibration.

No. 3177. GAS BURNERS: Webster Engineering Co., 419 W. Second St., Tulsa, Okla. 4 p. bulletin illustrating and discussing advantages of "Series F600" gas burners for steel firebox and sectional boilers, giving gas burner and control specifications.

No. 3178. INSTRUMENTS AND CONTROLS: Julien P. Friez & Sons, 4 N. Central Ave., Baltimore, Md. 24 p. catalog (K) featuring heating, refrigeration and air conditioning instru-

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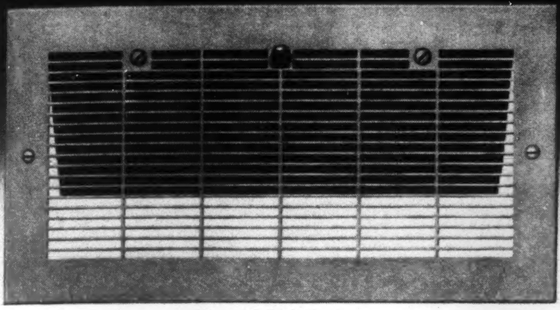

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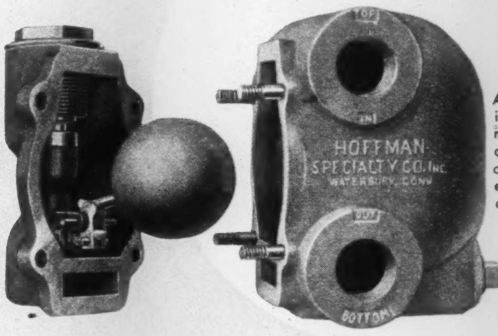

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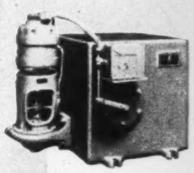

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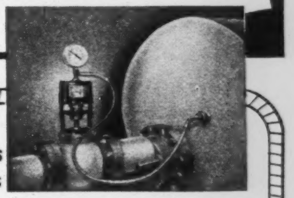

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16-page House Insulation Manual

PERMANENT THERMAL EFFICIENCY
.255 B.t.u. Peebles
AT LOWEST POSSIBLE COST

PALCO
INSULATION
T. M. Reg. U. S. Pat. Off.
WOOL

THE PACIFIC LUMBER COMPANY
SAN FRANCISCO CHICAGO LOS ANGELES NEW YORK

ments and controls for controlling, measuring and recording, including several new ones.

No. 3179. INSULATED PIPE UNITS: Ric-wiL Co., 1562 Union Trust Bldg., Cleveland, Ohio. 4 p. folder illustrating and describing new insulated pipe units, both single and multiple pipe types.

No. 3180. MOTOR AND MAINTENANCE EQUIPMENT: Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill. 84 p. catalog and handbook of motor and maintenance equipment, and electrical specialties.

No. 3181. NICKEL ALLOYS: International Nickel Co., Inc., 67 Wall St., New York. N. Y. 32 p. bulletin of technical information on nickel and nickel base alloys, and their use in design of corrosion resistant equipment.

No. 3182. PARTS AND SUPPLIES: Automatic Heating & Cooling Supply Co., 647 W. Lake St., Chicago, Ill. 188 p. catalog covering a complete line of parts and supplies for refrigeration and air conditioning, carefully indexed.

No. 3183. PIPE AND TUBING: Revere Copper and Brass, Inc., 230 Park Ave., New York, N. Y. 20 p. bulletin on copper and brass pipe and tubing, describing advantages of various types, illustrating applications, giving dimension and weight tables, and installation and engineering data.

No. 3184. PUMPS: Worthington Pump & Machinery Corp., Harrison, N. J. 6 p. bulletin (W-321-M3A) on "Jetflo" deep well pumps for air conditioning and industrial service, and other uses.

No. 3185. REFRIGERATION PRODUCTS: Cyrus Shank Co., 625 W. Jackson Blvd., Chicago, Ill. 12 p. catalog (5) on refrigeration products, including water regulators, gage sets, valves, dehydrators and strainers.

No. 3186. UNIT HEATERS: L. J. Wing Mfg. Co., 14th St. and 7th Ave., New York, N. Y. 16 p. bulletin (H-6AB) on "Featherweight" unit heaters, discussing advantages of unit heaters, features of these units, and giving engineering data and installation information.

No. 3187. VALVES: Crane Co., 836 S. Michigan Ave., Chicago, Ill. Booklet describing the service characteristics of globe valves and gate valves with chart to assist in selecting the right types for various services.

No. 3188. VALVE DISCS: Goetze Gasket & Packing Co., Inc., 60 Allen Ave., New Brunwick, N. J. Leaflet on improved resilient disc for renewable disc type valves.

No. 3189. WATER CONDITIONING: Permutit Co., 330 W. 42nd St., New York, N. Y. New bulletins on "Zeolite" water softening, equipment for treating water by the cold lime process, portable water softeners for oil well drillers, expansible strainer heads for filter and softener underdrain systems, and reprints on removal of iron and hardness from water, and conditioning water for the paper mill.

No. 3190. WELDERS: Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio. 4 p. specification bulletin (314-A) on 150 ampere "Shield-Arc Junior" welders with self-indicating dual continuous control.

Heating, Piping and Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [6-39]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1663 1664 1665 1666 1667 1668 1669
1670
3160 3161 3162 3163 3164 3165 3166
3167 3168 3169 3170 3171 3172 3173
3174 3175 3176 3177 3178 3179 3180
3181 3182 3183 3184 3185 3186 3187
3188 3189 3190

Name .... Title..........

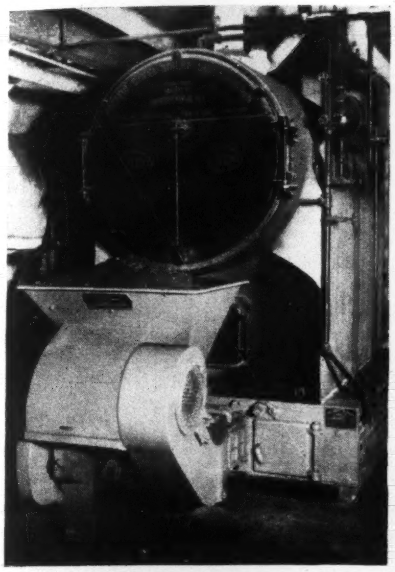
Company ....

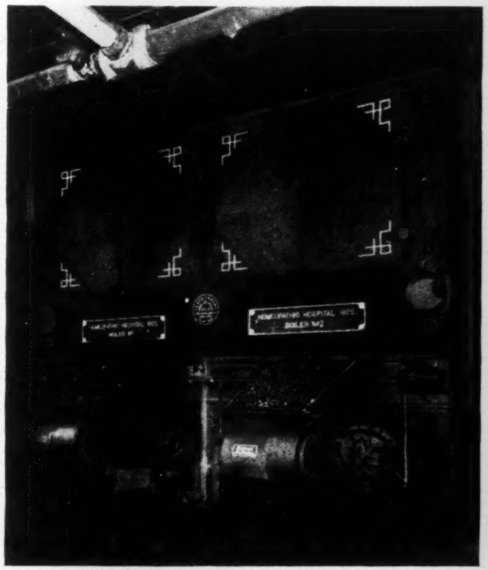
Address ....

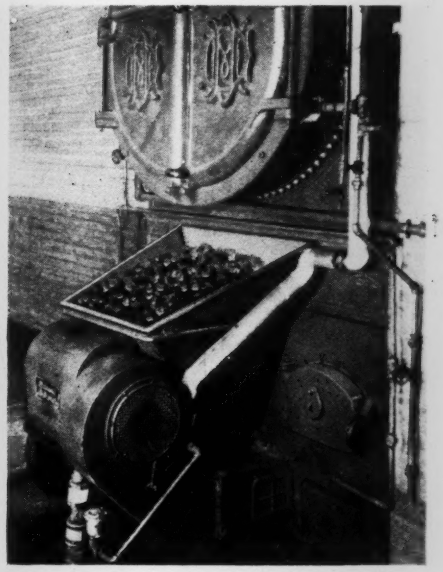
City .... State..........

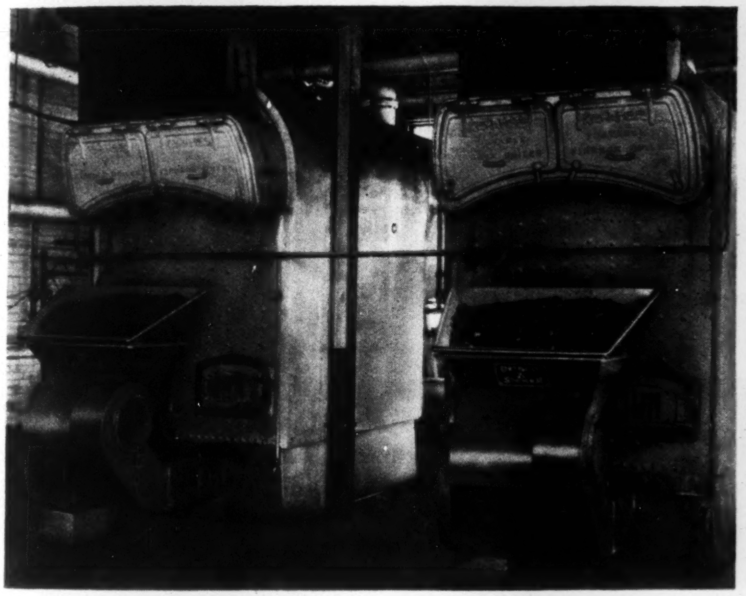
For All Types Of Heating Boilers

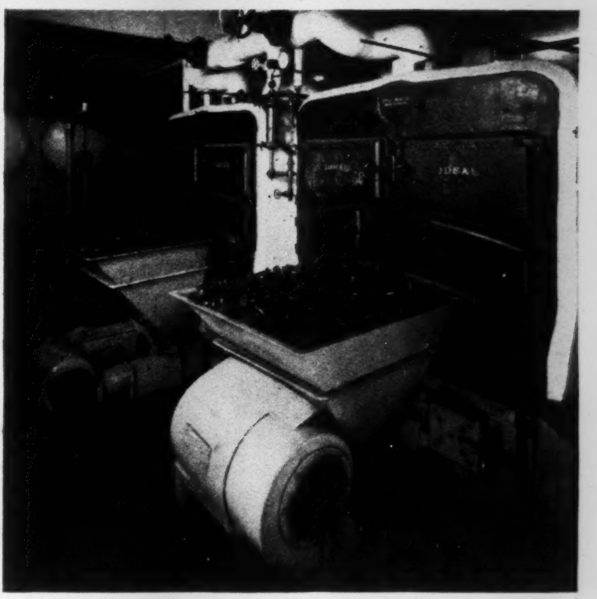
Detroit LoStoker

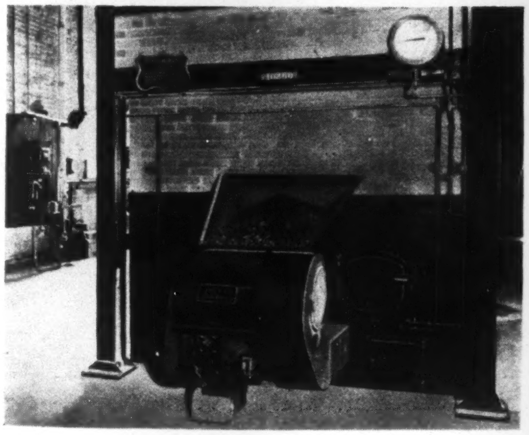












● Detroit LoStokers are built in many sizes and capacities. Built to fit the furnace of all types of heating boilers. LoStokers are adjustable plunger feed—side cleaning—with ash dumping grates, that eliminate arduous hand cleaning of fires.

• *High Efficiency and Capacity* • *Great Coal Savers* •

WRITE FOR BULLETIN No. 378

DETROIT STOKER COMPANY

SALES AND ENGINEERING OFFICES
GENERAL MOTORS BUILDING
DETROIT • MICHIGAN

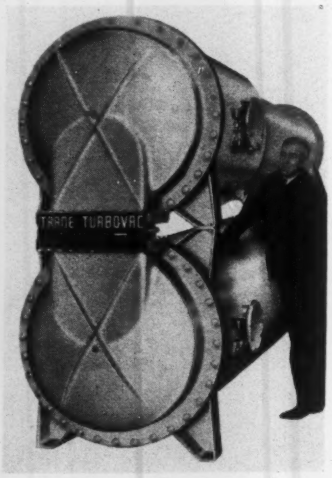
MAIN OFFICE AND WORKS
MONROE • MICHIGAN
District Offices in Principal Cities

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 118. Add the new products and companies listed here to your Directory Section which you received in your January, 1939, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Condensing Unit for Air Conditioning

No. 1671—The new "Turbovac" is a completely self-contained unit incorporating the mechanical essentials for providing chilled water for air conditioning. Within a heavy steel casing, it contains a compressor of the centrifugal type using a volatile refrigerant of the "Freon" family, a water chilling unit, and a condenser. The motors are inside the unit with the entire unit hermetically sealed and there are only two moving parts — the motor rotors. The compressor is powered by two motors of lesser horsepower than one of greater horsepower to make it possible to cut in one motor at a time, thereby reducing the load on the line and facilitating starting.

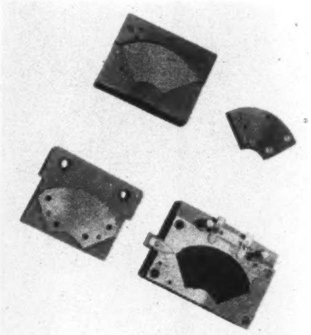


The unit is at present available in one size with a capacity range from 65 to 80 tons. It is approximately 11½ ft long, 8 ft high and 4 ft wide, and weighs slightly more than 12,000 lb. Units of 100, 150 and 200 ton capacities are to be added soon.

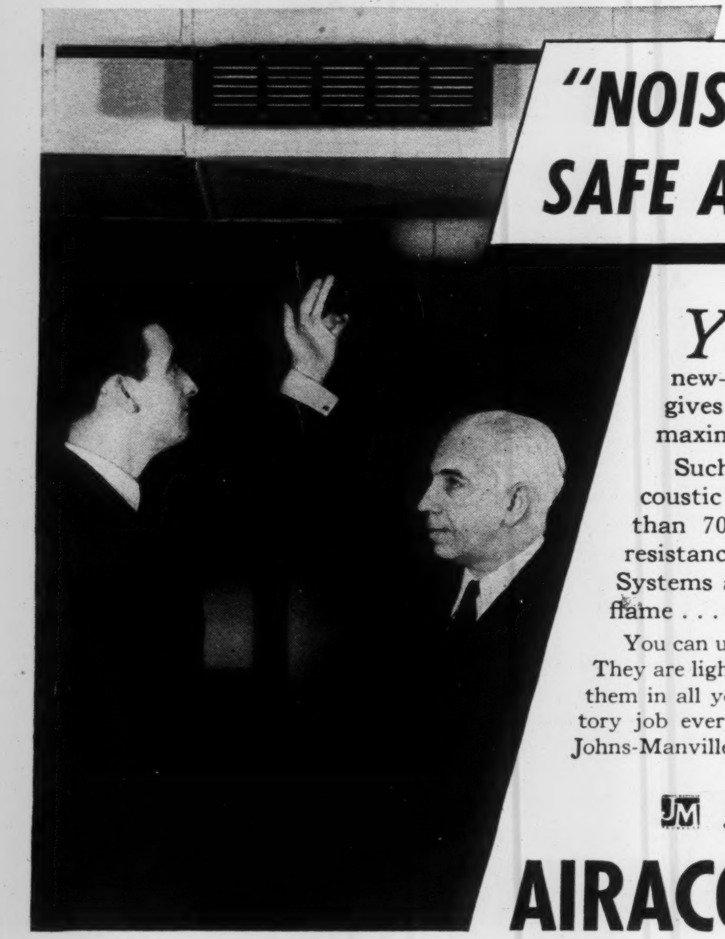
Impellers are fabricated of non-ferrous metal and are given a static and dynamic balance with the motor on which they are mounted. There are two fin and tube coils, one to chill the water and the other to condense the refrigerant, which are constructed of red brass. The shells are electrically welded of heavy steel plates, and all steel parts are heat treated after welding to prevent warping. All joints are sealed with neoprene gasket material.—Trane Co., LaCrosse, Wis.

Equipment for Making Duct Fittings

No. 1672—A method of producing elbow cheeks for duct fittings used in air conditioning and ventilating work has been devised and is of interest to contractors. Two special sets of punches and dies, one for blanking and one for forming, are furnished with one of the maker's standard foot presses, and can be attached by tightening four bolts, or can be easily removed. The blanking die cuts the piece out of the flat sheet and the forming die turns up both flanges on the curves in one operation. The illustration shows the forming dies above and the blanking dies below.



According to the manufacturer, studies have shown that the cost of producing elbow cheeks for duct fittings by this method is such that worthwhile economies result.—Whitney Metal Tool Co., 110 Forbes St., Rockford, Ill.



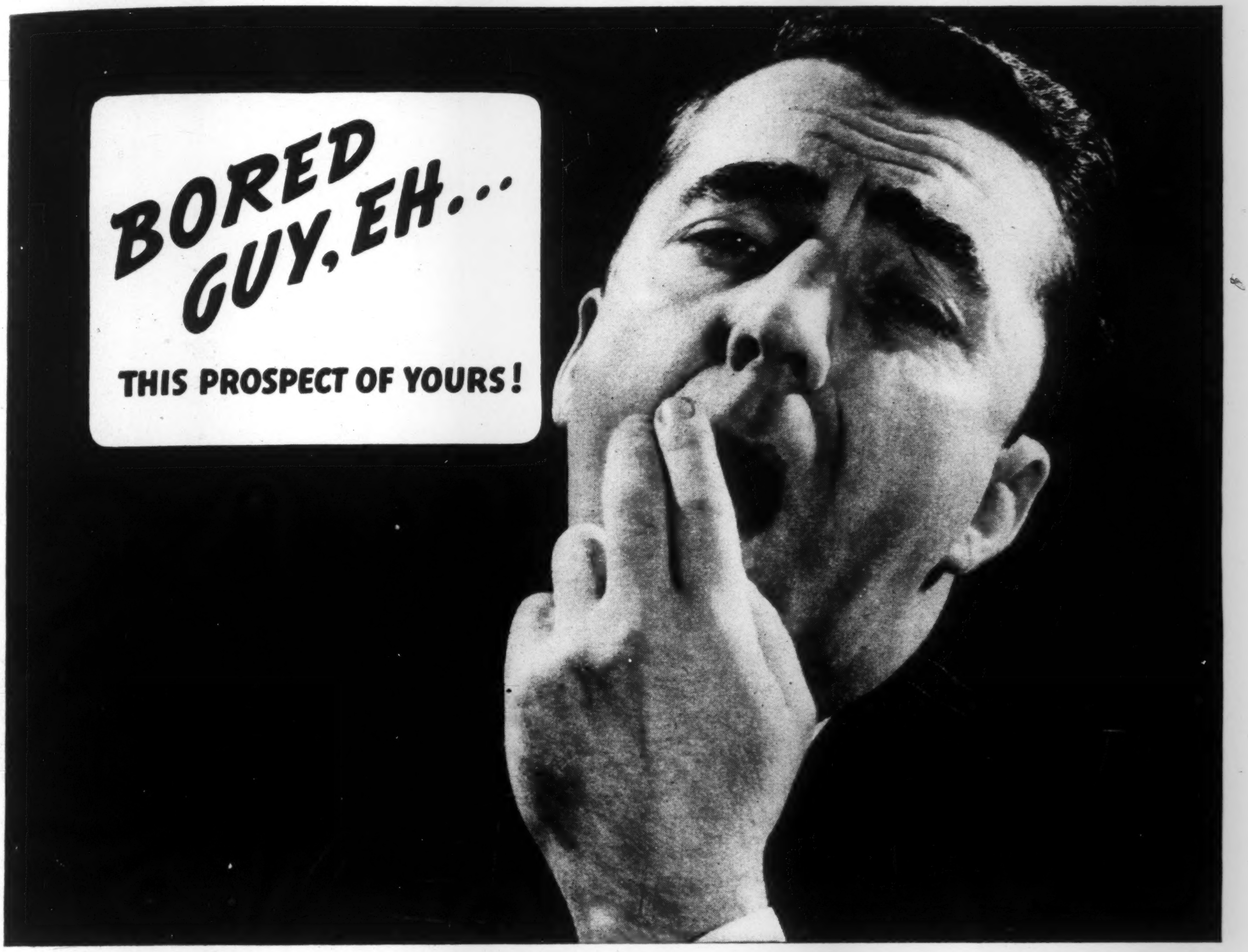
"NOISY? NO, SIR! AND SAFE AGAINST FIRE, TOO!"

YOU won't have complaints about noise in ducts if you install J-M Airacoustic Sheets as linings. This new-type material does a permanent quieting job. And it gives clients an extra advantage they'll all appreciate . . . maximum protection against fire.

Such important advantages are possible because Airacoustic Sheets are basically mineral. They absorb more than 70% of all sounds in ducts. Their high moisture resistance and transverse strength assure low upkeep. Systems are safer, for Airacoustic Sheets do not support flame . . . effectively retard the spread of fire.

You can use J-M Airacoustic Sheets for lining any type of duct. They are light in weight, easy and economical to apply. Including them in all your installations helps assure a thoroughly satisfactory job every time. For details on this modern lining, write Johns-Manville, 22 East 40th Street, New York, N. Y.

JM Johns-Manville
AIRACOUSTIC SHEETS For Duct Linings


BORED GUY, EH...
THIS PROSPECT OF YOURS!

● Your Salesmen know this type of buyer. He pretends to be painfully bored. He parries sales arguments with ill-concealed yawns . . . feigns ennui as a mask of sales resistance. But when these same men pick up Heating, Piping & Air Conditioning, looking for ideas about the heating, piping and air conditioning business, they hang up those defensive masks. When your "bored" prospects read Heating, Piping & Air Conditioning, they are alert enough. For one thing, it is on their desks by *invitation.* They pay subscription cash to get it. And they are with an editor in whom they have confidence. They can be *themselves!*

Your advertising in Heating, Piping & Air Conditioning will work for your salesmen between their calls. And it will help them penetrate those masks of sales resistance.

Highest editorial standards and publishing integrity.

ABP

HEATING, PIPING & AIR CONDITIONING

← *bears the two hall-marks of known value* →

ABC

Proved reader interest in terms of paid circulation.

HOWELL Also Builds Special-Purpose Motors . . . For Your Special-Purpose Air Conditioning or Piping Jobs

FAST DELIVERIES ON EITHER TYPE

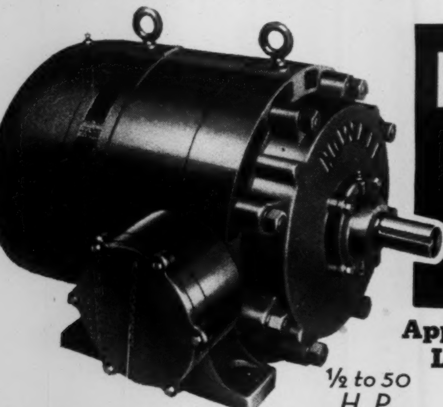
TOTALLY-ENCLOSED
(FAN-COOLED)
Polyphase and Single Phase

1 to 75 H. P.

Designed to Keep Moisture, Dirt, Dust or Fumes from Motor Windings

Use HOWELL Totally-enclosed, Fan-cooled Motors on your tough jobs—where ordinary motors are likely to fail because of inadequate protection against abrasive or corrosive action. Ideal for use in process industries, metal-working plants, etc. Working parts COMPLETELY SEALED from outside atmosphere. Fan cooling protects against over-heating.

Note New STREAMLINED housing which adds ultra-modern appearance to proven performance. Write for complete details.



EXPLOSION-PROOF
Polyphase and Single Phase

½ to 50 H. P.

Approved by Underwriters' Laboratories, for Class 1, Group D Locations

Use HOWELL Explosion-proofs wherever inflammable liquids or gases are handled or stored. Motor housing (totally enclosing all working parts) strong enough to withstand any inside-motor explosion and prevent escape of flames. Efficient fan-cooling prevents any temperature rise sufficient to ignite surrounding gases.

COMPLETE protection assured by HOWELL'S unique "Battleship" construction. All details covered in our new Bulletin EK3.

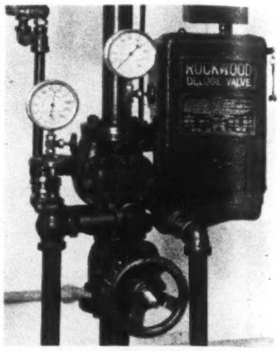
HOWELL RED BAND MOTORS Make Good on Hard Jobs

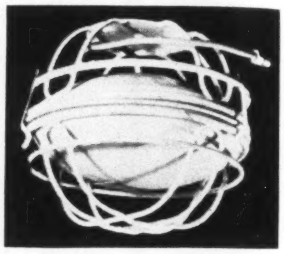
QUIET RUNNING! *HOWELL Motors meet the most exacting requirements as to silent performance. We make sure of it by our Quietness Test—conducted in sound-proof laboratory, using precision instruments. HOWELL Motors are ALWAYS quiet running.*

HOWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN
Representatives In All Principal Cities

Automatic Fire Control for Air Conditioning Installations

No. 1673—The "Dualguard" automatic fire control system has been developed especially for air conditioning installations and operates on the "rate of rise" principle of fire detection. Under normal conditions it operates when the temperature rises at the rate of 15 deg per min—an abnormal temperature rise such as a fire would cause. But where an air conditioning system is also used for heating, the release devices can be adjusted to meet the conditions causing it to operate only at a faster rate of temperature rise.





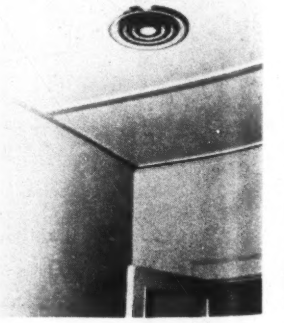
Basically, such a system does three things: it shuts off fan motors; closes dampers; and deluges the filters with water. Where conditions demand, the system can be arranged to accomplish various other individual operations or combinations of operations, and it can be installed and operated in conjunction with outside water curtains over air inlets in the outside walls of a building.

The top illustration shows a typical deluge valve with release mounted alongside used to control the flow of water to open sprinklers installed above the filters. On receiving an air pressure impulse from the heat actuated device (shown below) the deluge valve produces water at the sprinklers. The heat actuated device is a hollow metal chamber surrounded by a wire guard and heat from a fire operates it, due to an abnormal increase in temperature causing an air pressure impulse to be transmitted through copper tubing to the release devices.—Rockwood Sprinkler Co., 38 Harlow St., Worcester, Mass.

Cast Aluminum Ceiling Outlets

No. 1674—A new ceiling outlet for air conditioning work, just developed, was designed on the bases that it should be approximately flush with the ceiling to be as inconspicuous as possible, that it should deliver the supply air in a horizontal path approximately parallel with the ceiling, and the supply air delivered by it should reach room temperature in the shortest possible distance, the manufacturer states. The form of the air passages between the concentric rings of the outlet produces a series of circular jets and between the jets is a series of circular low pressure areas. Thus, each circular jet of supply air turns outwardly on leaving the confinement of its passage to fill the nearest adjacent low pressure area. According to the manufacturer's tests, the resulting path of the supply air is approximately parallel with the ceiling.

The outlet is composed entirely of a series of concentric rings, and the surfaces of the outer ring and inner members are fluted to enhance the beauty of the design. The standard outlet is furnished with the raised portions of each ring highly polished and the bal-

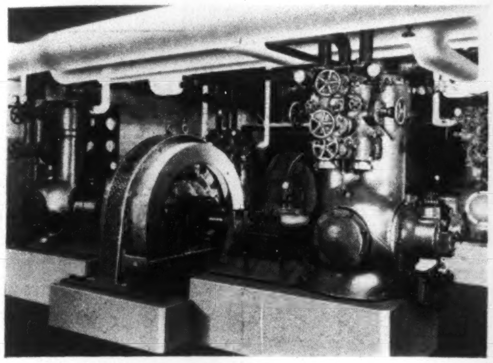


525 tons

OF REFRIGERATION FOR KRAFT-PHENIX BUILDING

THREE DIFFERENT TYPES OF AIR CONDITIONING SUPPLIED BY *BAKER*

ONE of America's largest building projects of the past ten years is the recently-completed Kraft-Phenix international headquarters and manufacturing plant in Chicago. Housing executive and general offices, research laboratories, and the factory producing nearly 100 different brands of cheese as well as salad dressing, the Kraft building includes ten acres of floor space. BAKER equipment provides three different types of air conditioning: first, air conditioning all office space for comfort; second, maintaining low temperatures in the cold storage units; and, third, regulating temperature, humidity, and air circulation in the manufacturing rooms.



Burge Ice Machine Co., Chicago, Baker Central Distributor

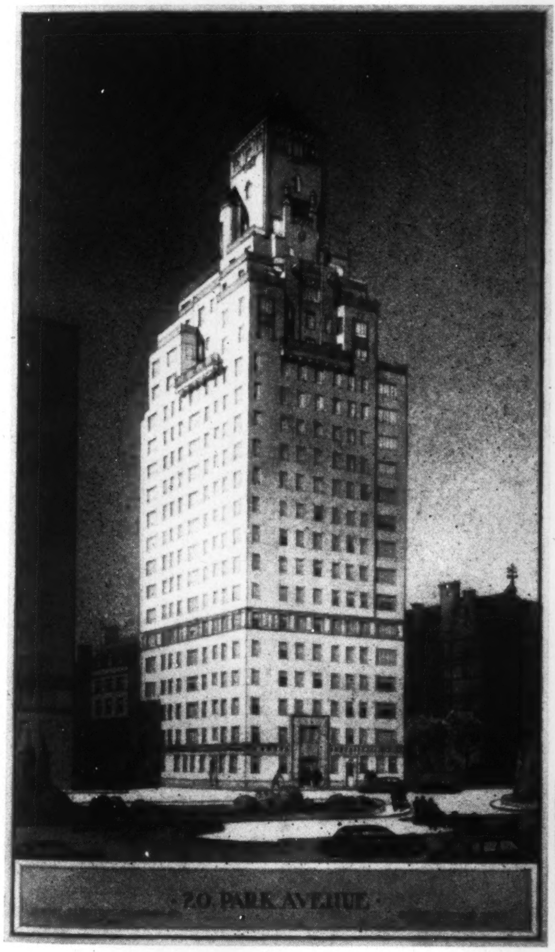
In this huge installation—one of the largest factory-office building systems in the country—BAKER demonstrates again the Economical Efficiency that has made it a popular favorite all over the world. Whether your air conditioning or refrigerating requirements are large or small, get the interesting facts about BAKER units before you buy.

BAKER ICE MACHINE CO., 1508 EVANS ST., OMAHA, NEBR.

Branch Factories: Fort Worth, Los Angeles, Seattle
Eastern Sales: New York Central Sales: Chicago
Sales and Service in All Principal Cities

BAKER

AUTHORITY ON MECHANICAL COOLING FOR 35 YEARS



Styled for Tomorrow CONDITIONED *by* UTICA

This smart new apartment, the 20 Park Avenue Building, strikes a note of the future with its soaring grace and trim design. It is truly modern—the first New York building to be completely wired for television.

The architects—Emery Roth & Sons, and the builders—Diesel Electric Co., Inc., can be justly proud of this achievement in advanced planning and streamlined construction.

Within, a group of physicians' offices and reception rooms on the main floor are completely air-conditioned with the Utica Washed Air-Conditioning System. These doctors and their patients will appreciate the refreshing atmosphere that true washed air affords. When it is muggy and hot outside—they will enjoy the cooling, draftless, purified air from a Utica Air Conditioning System—automatically controlled for comfort.

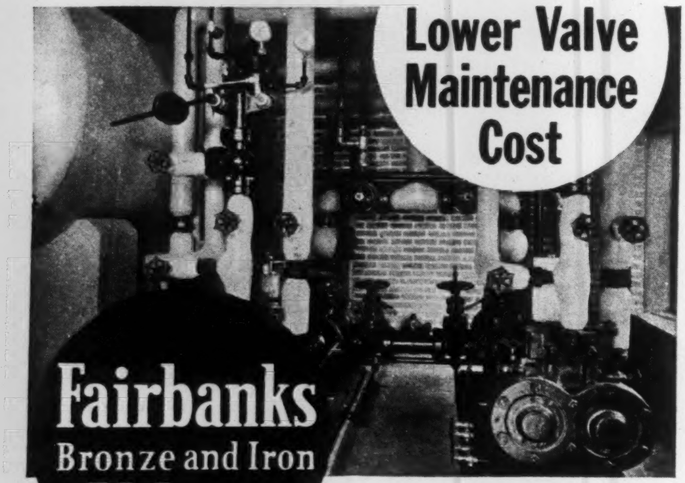
When *your* customers are melting in the summer heat—refresh them with the thought that they, too, can have the benefits of cool, dry summer air plus winter heating and true washed air conditioning at a surprisingly reasonable price.

Utica Air Conditioners are made in a wide range of models and capacities for residential or commercial applications. Write us today for complete literature and engineering data on the Hydro-Air System of Washed Air Conditioning.

UTICA RADIATOR CORPORATION

Boilers • Radiators • Convectors • Air Conditioners

UTICA, N.Y.



Lower Valve Maintenance Cost

Fairbanks
Bronze and Iron
Valves

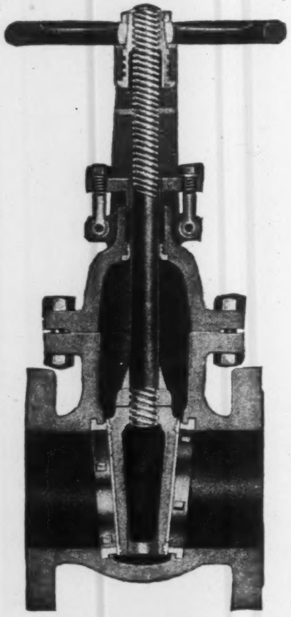
Is it any wonder that so many plants are using Fairbanks Bronze and Iron Valves when you consider all you get in these valves!

. . . . Bodies and bonnets with a tensile strength of 5,000 to 10,000 lbs. greater than the minimum required by the Amer. Soc. for Testing Materials . . . stems with a greater number of threads in contact with bonnet and an average strength of 65,000 lbs. . . . protected top seat above stem threads which sediment can't reach and prevent tight closing . . . extra deep stuffing box . . . greater length pipe threads to prevent damage to diaphragm and seats . . . slide-on disc holder . . . renewable seat rings or wedges that can be replaced without removing valve from the line . . . asbestos disc rings that give long and efficient service with steam, hot water or cold water . . . strong union nuts with large hexes for a firm wrench grip.

Distributors everywhere sell Fairbanks Valves in types and sizes to meet practically every condition.

You'll find other features in our Catalog No. 21. Write for a copy.

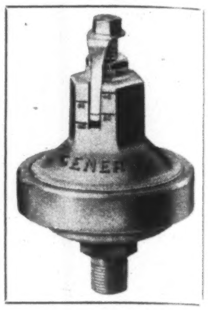
THE FAIRBANKS COMPANY
Valves, Dart Unions, Hand Trucks and Wheelbarrows
396 Lafayette Street,
New York, N. Y.
Boston, Pittsburgh—Distributors in Principal Cities
Factories: Rome, Ga.
Binghamton, N. Y.



ance dull, the contrast of the two finishes adding to the attractiveness.—Tuttle & Bailey, Inc., Corbin Ave., New Britain, Conn.

Water Hammer Eliminator

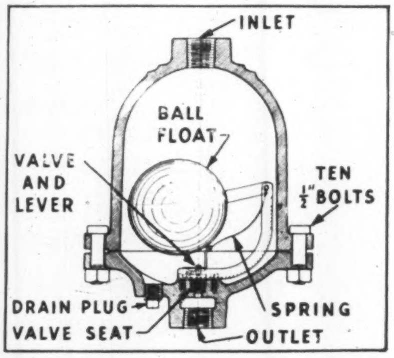
No. 1675—The "silencer" illustrated has been developed to eliminate water hammer in hot or cold water lines and depends upon mechanical operation rather than an air cushion. The base containing the water is made of bronze and the water comes in contact only with rustproof materials.



To stop hammer in cold water lines, the device is installed in a tee at the top of the vertical line running up from the water meter. On hot water lines it should be located near the tankless heater or the storage tank. The device is equally effective on rigid piping or copper tubing, the maker states.—General Fittings Co., 123 Georgia Ave., Providence, R. I.

Air Trap for Compressed Air Lines

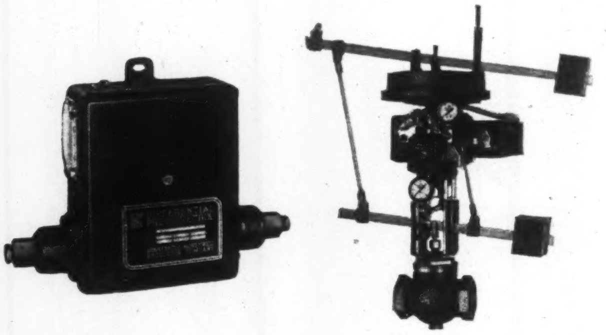
No. 1676—A new automatic snap action mechanical trap for draining water from compressed air lines, tanks, separators, and aftercoolers has been developed. As shown in the diagram, it has a ball float connected to a short valve lever through a flat strip of stainless spring steel. In the closed position the spring is bowed downward and as water enters the trap body the float rises—bending and storing energy in the spring. Just before the float reaches the top of the trap, the spring bends past dead center and the energy snaps the valve wide open. The cycle is then reversed and the valve snaps shut.



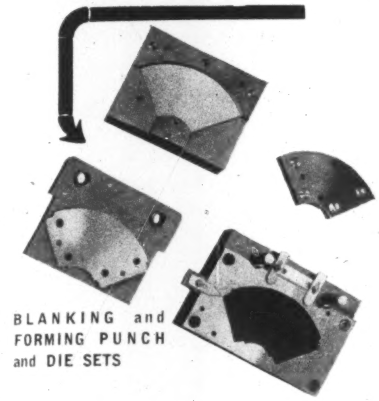
According to the maker, the capacity is 1400 lb per hr of water at 125 lb pressure and 1000 lb per hr at 250 lb pressure.—Armstrong Machine Works, 874 Maple St., Three Rivers, Mich.

Differential Controllers; Combustion Regulators

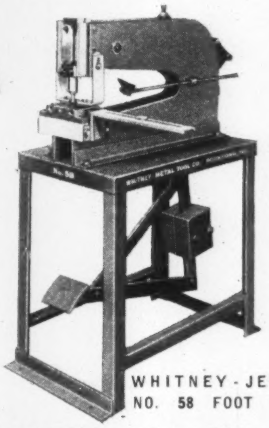
No. 1677—The new differential controllers illustrated are designed with two bellows assemblies that oppose each other and react to variations in the difference in pressure or temperature between the high and low pressure or temperature elements. The pressure control can be installed with an orifice to govern



PUT THESE .... ON HERE ... and MAKE THESE

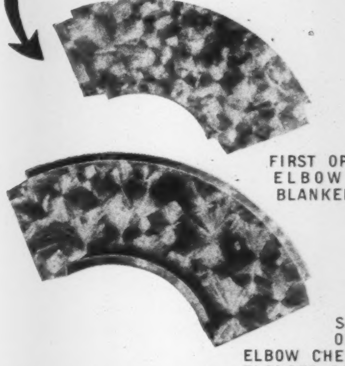


BLANKING and
FORMING PUNCH
and DIE SETS



WHITNEY-JENSEN
NO. 58 FOOT PRESS

200 AN HOUR!



FIRST OPERATION:
ELBOW CHEEK
BLANKED OUT.

SECOND
OPERATION:
ELBOW CHEEK
FLANGED BOTH SIDES.

TIME STUDY SHOWS COST OF MACHINE AND DIES RETURNED IN 2½ DAYS!

Test made on production of Cheeks for 3½" Duct Elbow, 26 ga. galvanized iron. Labor at $1.00 per hour.

Made by hand, 15 pcs. per hr......$ 6.66 per 100
Made on machine, 200 pcs. per hr... .50 per 100
Daily saving, labor only, 8 hr. day.......$98.56
Cost of No. 58 Foot Press, including Blanking and Forming Dies, also standard round punch and die holder, bolster plate, and gauges.....................$253.50
(F.O.B. Rockford, Illinois)
Cost of equipment returned in 2½ days.
Note: Die cut pieces far superior to hand made.

WHITNEY-JENSEN METHOD REDUCES COST 80%!

By using a standard Whitney-Jensen No. 58 Foot Press equipped with special blanking and forming dies, Elbow Cheeks for duct fittings can be turned out complete at the rate of 200 an hour or better. IN ADDITION, the No. 58 Foot Press can be used for dozens of other jobs throughout the shop. Write for particulars.

WHITNEY METAL TOOL COMPANY
180 FORBES ST., ROCKFORD, ILL.

The Completeness of the CURTIS Line Assures the Correct Equipment for Every Air Conditioning or Refrigeration Need

WHETHER you buy, sell, install or specify air conditioning or refrigeration equipment, there's a Curtis unit that fulfills every requirement. Curtis covers a wide range of markets—makes possible greater sales. And you can specify Curtis products with absolute confidence.

The Curtis Store and Office Cooler fulfills the air conditioning demands of all classes of retail establishments. It's a complete, factory designed, packaged air conditioning unit. It mechanically cools, dehumidifies, circulates and filters the air—is quickly and easily installed with only water and electrical connections needed—adaptable for heating, too. It is offered in 3 and 5 ton sizes.

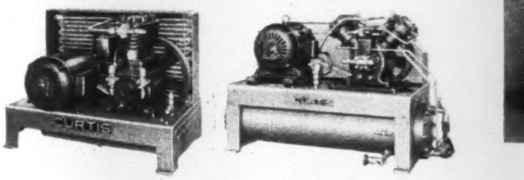
The Curtis Line of Condensing Units includes sizes from 1–6 H. P. to 30 tons air and water cooled—also unit coolers, coils, evaporative condensers, etc. Every Curtis product is precision engineered to deliver economical, efficient, care-free performance throughout an exceptionally long life.

Curtis Refrigerating Machine Company

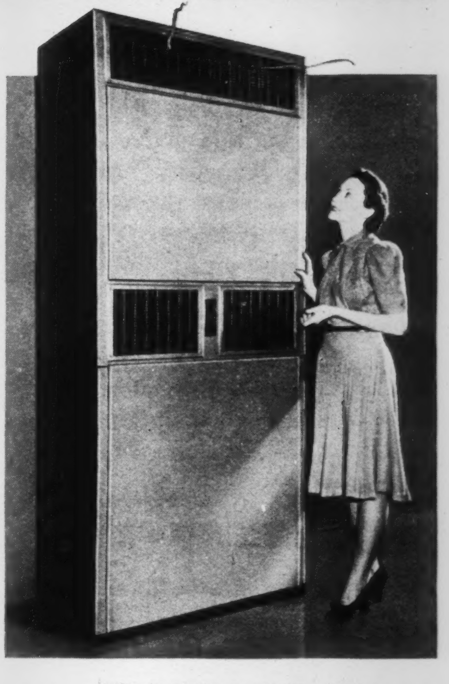
Division of
Curtis Manufacturing Co.
1950 Kienlen Avenue,
St. Louis, Mo.

CURTIS
REFRIGERATION
AIR CONDITIONING AND COMMERCIAL

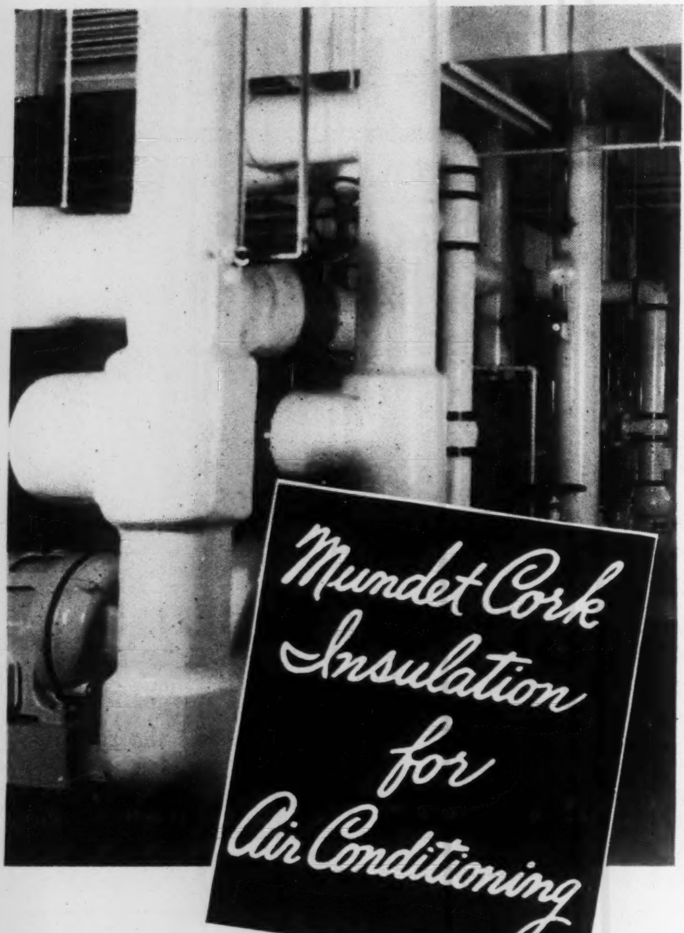
"Builders of Condensing Units Since 1926"



48 Air Cooled Units—45 Water Cooled Units —⅙ to 30 H.P.



The Curtis Store and Office Cooler
3 and 5 ton sizes



PERMITS

Precise Temperature Control

Mundet Cork Insulation provides a natural barrier to heat flow — its efficiency and economy proved in more than a generation of service. The Mundet Insulation you buy today is fabricated by the most modern methods into Corkboard and Moulded Cork Pipe Covering. Mundet Insulation meets the requirements of efficient air conditioning, and is guaranteed to give long service. Mundet offices in principal cities offer prompt, personal contact. Ask us for suggestions and estimates covering the application of Mundet Cork Insulation to your specific needs. There's no obligation to purchase. Address your inquiry to Mundet Cork Corporation, Insulation Division, 65 South Eleventh Street, Brooklyn, N. Y.

- *Prevent vibration troubles by specifying Mundet Natural Cork Isolation for fan foundations and motor mounts. Description sent promptly.*

MUNDET CORK INSULATION

flow of steam or liquids, or as an alarm device on cooling water systems or for large refrigeration condensers. The differential thermostats are similar to the pressure controls but have temperature elements instead of pressure assemblies. They are recommended by the maker for water conservation on air conditioning jobs using well water, preventing condensation in underground wiring tunnels, and other uses.

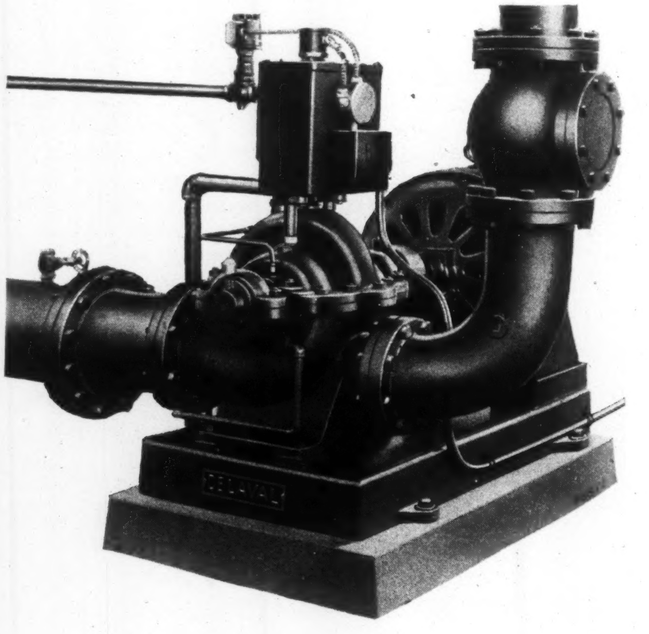
The combustion regulator illustrated is designed to hold steam pressure in a gas fired boiler within close limits, and to control air supply to the burner in conjunction with the gas to improve combustion efficiency. Installation is simple as the entire control is mounted on the gas valve bonnet at a single point. A ¼ in. steam supply and exhaust line and connection to the electric service complete the installation.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn.

Improved Priming of Pumps

No. 1678—With an improved submerged suction priming method for centrifugal pumps, the water level in the suction space is automatically raised above the eye of the pump impeller when the pump is initially put into service. Thereafter, the suction line and pump casing are normally kept full, so that discharge begins immediately the motor is started; if the priming should be lost, the pump motor is shut down until the water level has again been raised above the pump suction opening.

A priming chamber, mounted above and on the pump casing, contains an air evacuating device drawing from the priming chamber through a check valve and discharging to waste. Two pairs of small pipes, one the wet pipe and the other, inside the first, the dry pipe, connect the priming chamber to each of the suction bells of the pump. In addition, the pump discharge line has the usual check valve and shut off valve.

When the ejector is started, air is withdrawn from the priming chamber, the pump casing and the suction line, and the water rises through the latter, filling the pump and eventually passing up through the wet pipe and rising in the priming chamber. The starting and stopping of the ejector is controlled by a solenoid energized from an electrical device which responds to the water level within the priming chamber, this same device also controlling the starting and stopping of the motor driving the main pump. The governing impulses originate from two electrodes which enter through the top wall of the priming chamber and terminate at different levels. After the initial evacuation the eductor does not operate unless there is excessive air leakage or in case the pump is shut down for a con-



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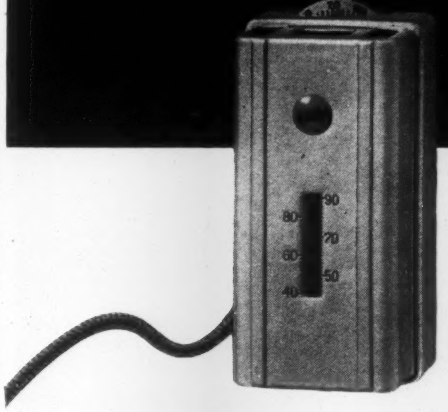
for Buildings of All Types



Sylphon Electric Control Valves now make it possible for you to offer temperature control for one room, a section, or an entire building as readily as you provide for thermostatic control of a residence heating system.

Merely replacing ordinary radiator valves in each room to be controlled—or the main steam valves to a building floor or zone—they automatically regulate the amount of steam admitted to the radiators to provide uniform temperature of predetermined degree at the breathing line.

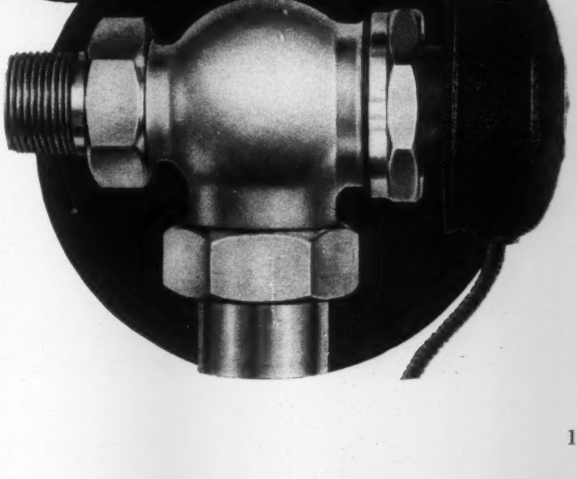
Actuated by an attractive wall thermostat which may be connected to operate one or several valves from a local or remote point.

Operation is simple, fool-proof.

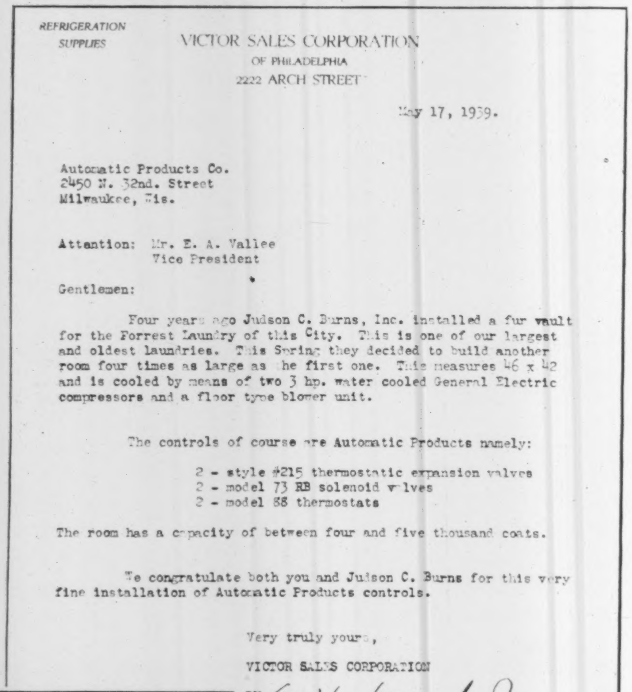
This system is noiseless. There are no levers, no commutators, no wearing parts, no compressed air, no mechanism to adjust or lubricate. It is guaranteed to be trouble-proof. Write for Bulletin NE-70.

The Fulton Sylphon Co.
KNOXVILLE, TENNESSEE
Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England

FULTON Sylphon FOR TEMPERATURE CONTROL



5000 Fur Coats
Protected by
Valve
DEPENDABILITY



REFRIGERATION
SUPPLIES

VICTOR SALES CORPORATION
OF PHILADELPHIA
2222 ARCH STREET

May 17, 1939.

Automatic Products Co.
2450 N. 32nd. Street
Milwaukee, Wis.

Attention: Mr. E. A. Vallee
Vice President

Gentlemen:

Four years ago Judson C. Burns, Inc. installed a fur vault for the Forrest Laundry of this City. This is one of our largest and oldest laundries. This Spring they decided to build another room four times as large as the first one. This measures 46 x 42 and is cooled by means of two 3 hp. water cooled General Electric compressors and a floor type blower unit.

The controls of course are Automatic Products namely:

2 - style #215 thermostatic expansion valves
2 - model 73 RB solenoid valves
2 - model 88 thermostats

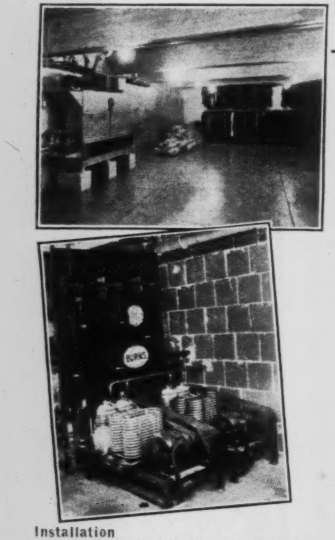
The room has a capacity of between four and five thousand coats.

We congratulate both you and Judson C. Burns for this very fine installation of Automatic Products controls.

Very truly yours,

VICTOR SALES CORPORATION

BY A. H. Holcombe Jr.



Installation
Fur Storage at Forrest Laundry, Philadelphia, Pa.
Air Conditioning Unit—
General Electric Compressor
Buffalo Forge Blower Unit

The Safety of 5,000 Valuable Fur Coats in storage is a great responsibility to any equipment. In the largest Fur Storage Room in Philadelphia, at Forrest Laundry, ACCURATE TEMPERATURES so necessary to Fur protection, are MAINTAINED BY A-P THERMOSTATIC EXPANSION VALVES, SOLENOIDS and THERMOSTATS.

Refrigeration Engineers have learned from rich experience that for the best and most particular installations, demanding the utmost in accurate temperature control, it's always safest to install A-P Valves. They've never failed in absolute DEPENDABILITY on any job, large or small, in either Refrigeration or Air Conditioning.

Installed by—Judson C. Burns, Philadelphia.

Sold through—Victor Sales Corp., Philadelphia.

A-P Model 215 Thermostatic Expansion Valve

AUTOMATIC PRODUCTS COMPANY
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● Refrigeration Parts Jobbers, Who recognize Quality, Stock A-P Valves. ●

DEPENDABLE
THE BY-WORD FOR A-P VALVES

siderable period, and it then operates only for a few seconds at a time. If the pump can, without danger, be operated dry the submerged suction priming equipment may be arranged to prime the pump while running, as where the pumps are driven by synchronous motors with a limited pull-in torque.—De Laval Steam Turbine Co., 300 Nottingham Way, Trenton, N. J.

Instruments and Controls

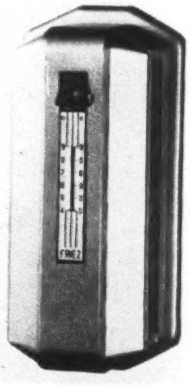
No. 1679—Among the new instruments and controls recently announced are a dial indicating thermometer, a potentiometer controller, and a new line of electric valves.

WHEELCO THERMOMETER
300
200
400
100
500

The thermometer is available in a long distance type for installation at a point away from where the temperature is taken, and a stem pipe for mounting at the temperature point. Available for temperatures ranging from 0 to 1000 F. The potentiometer controllers (not illustrated) are adapted to actuate any customary type of fuel valve or electric contactor; they are of all electric design and entirely non-mechanical, the maker states.

The electric valves (not illustrated) are entirely self-contained and are offered for throttling of gas, oil or air flow to furnaces, ovens and similar heating applications.—Wheelco Instruments Co., 1933 S. Halsted St., Chicago, Ill.

Thermostats of Deluxe Design



No. 1680—New "deluxe" room thermostats are offered in a variety of single and dual blade types, with or without anticipation, for heating, cooling, day-night, or two stage temperature control applications.

Special models are available for use with relays, valves, damper motors, stokers, gas, and oil burner controls.—Julien P. Friez & Sons, 4 N. Central Ave., Baltimore, Md.

Booklets, Reports and Papers

Safety Code for Refrigeration

Copies of the revised American Standard Safety Code for Mechanical Refrigeration (B9-1939), approved by the ASA April 20, are available for 20c for single copies from the American Society of Refrigerating Engineers, 37 W. 39th St., New York, N. Y. Numerous national organizations were represented on the sectional committee responsible for the revised code.

In the code, the types of places used for human occupancy which may be equipped with automatic mechanical refrigeration, are grouped in accordance with the nature of the occupancy.

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TRADE FRICK MARK
Air Conditioning

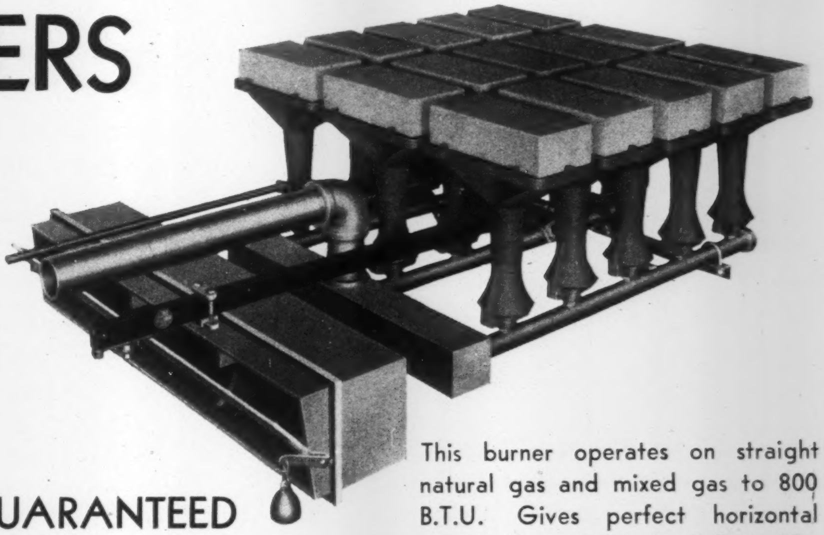
As evidenced by 50 jobs, totaling nearly 3,000 tons of refrigeration, in theatres, stores, offices, restaurants, hotels, hospitals, banks, boats, bowling alleys, and industrial plants. All credited to the Paul J. Vincent Co., Engineers.

Baltimore typifies the preference given Frick Air Conditioning by careful buyers everywhere. Let us refer you to Frick installations near you. Write

FRICK CO., Waynesboro, Penna.

WECO-N.G.E. Series F600 GAS BURNERS

These burners are available for ratings from 50,000 to 10,000,000 B. T. U. output, for use in heating boilers, power boilers—in any metal firebox or sectional boiler. Featuring flexibility to meet various firebox shapes and sizes at various gas pressures, and low draft loss. Full automatic controls that operate properly can be easily applied.



GUARANTEED VIBRATIONLESS

This burner operates on straight natural gas and mixed gas to 800 B.T.U. Gives perfect horizontal distribution. Write for Bulletin No. F600H.

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TULSA —DIVISION OF— **OKLAHOMA**

Surface Combustion Corp. . . . . Toledo, Ohio

places in which persons are harbored or confined being subjected to the most stringent rules. Refrigeration systems are defined in accordance with the basic designs from a safety standpoint and each type of system is given application limits on the basis of safety to human life. Refrigerants are divided into three groups, dependent upon the hazards they present in an automatic mechanical refrigeration system. Grouping has been based on published results of experimental data and the application and operating experience of the committee members.

Standards for Condensers

The Heat Exchange Institute, 90 West St., New York, N. Y., has published the second edition of the condenser section of its standards as a 38 page, 8½ x 11 in., paper covered booklet. It is divided into Part 1 on surface condenser standards, and Part 2 on barometric and low level jet condensers.

The booklet contains material on nomenclature with definitions and illustrations, condenser performance, materials of construction, atmospheric relief valve sizes, air pump capacity, tubing characteristics, air-water vapor mixture data, pressure-temperature conversion tables, and tables of logarithms. The price of the publication, which may be obtained from the Heat Exchange Institute, is $1.00 per copy.

Book Reviews

New Text on Air Conditioning

["Air Conditioning—Principles and Practice," by Burgess H. Jennings, Associate Professor of Mechanical Engineering, Lehigh University, and Samuel R. Lewis, Consulting Engineer. 1st ed. 1939. 467+xvi pp., 5⅞x8¾ in., flexible binding. Published by International Textbook Co., Scranton, Pa. Price, $4.00.]

Fundamentals of air conditioning are presented in this new textbook as a sound working basis for both engineering students in the upper college classes, and practicing engineers. Many completely solved illustrative examples are presented and problems for solution are included in many of the chapters. The authors' claim to originality rests largely on methods of presentation and on selection and compilation of material, they state in the preface, as the technical literature has been freely consulted.

Chapters are given on the background of air conditioning; fundamental definitions; heat and thermodynamics; air and humidity calculations; air conditioning for human comfort; heat transfer and transmission coefficients; the heating load; cooling load computations; steam heating; hot water heating; warm air heating; fluid flow, air distribution systems; heat transfer elements; boilers; air cleaning; refrigeration; control of air conditioning refrigeration apparatus; industrial air conditioning; and miscellaneous air conditioning topics.

New Book on Blueprint Reading

["Simple Blueprint Reading, with Particular Reference to Welding and Welding Symbols." 1st ed. 1939. 140 mimeographed pp., 8½x11 in., paper bound. Published by Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio. Price, 50c per copy in U. S., 75c elsewhere.]

While this book has been compiled and published primarily for welders it contains information of value to anyone concerned with mechanical construction, its object being to provide information and instruction on the reading of blueprints and drawings. Eighty-five illustrations are included and show practical examples of drawings of a number of machine parts, pipe connections, general construction, tanks, etc.

A list of questions and answers at the end of the book allows the student to test his knowledge.

Selinsgrove Hospital,
Selinsgrove, Pa.

Perfection Stove Co.
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Full Protection at Every Point:

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▲ Loc-liP Side Joint, including Bells
—for easy and visible cementing.

▲ Bell End Joint—for permanent, positive seal and alignment.

▲ 3 Main Pieces to each 2 feet of System
—for lower installation cost.

▲ Adequate Base Drain Foundation
—for ample drainage and support.

REMEMBER—a Ric-wiL system, with genuine Dry-paC Insulation, keeps your steam lines permanently tight, dry, and at least 90% efficient. Descriptive bulletin and test data sent promptly on request.

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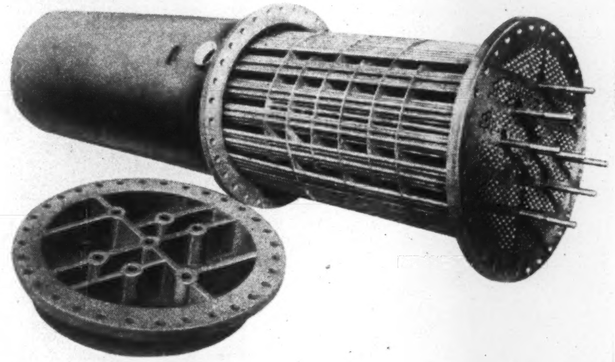

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This careful engineering is why there has never been a Patterson Freon Water Cooler that failed to deliver more than its rated capacity. The skillful manufacture is why more and more engineers and users insist on Patterson Freon Water Coolers.

Patterson dependability always assures a perfect air conditioning installation.

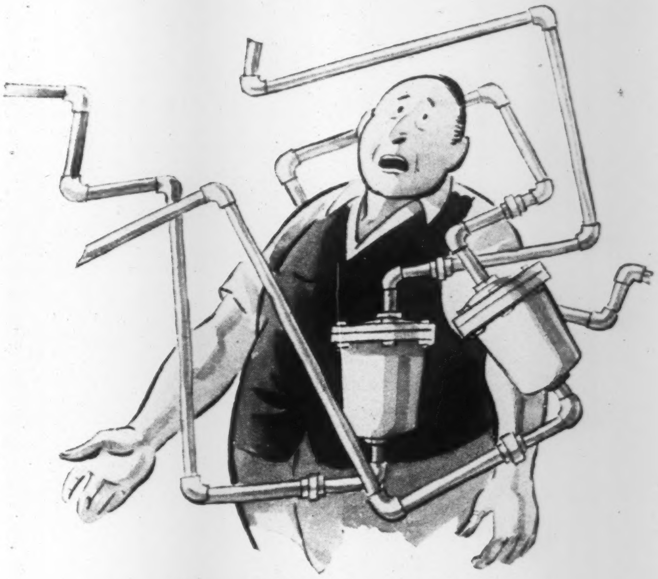
May we design a Patterson Freon Cooler for your next installation?

Write for catalog.

The Patterson-Kelley Co., Inc.
107 Warren St. East Stroudsburg, Pa.

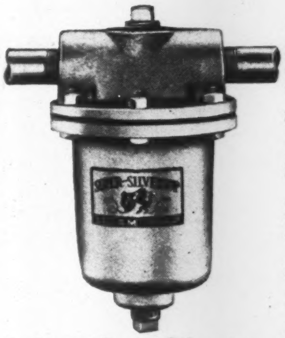
Patterson Freon

Water Coolers



Traps sketched here are old style 1931 model Anderson steam traps with their piping. Below is a photo of the present model Anderson Super-Silvertop steam trap with simplified piping.

Let MODERN ENGINEERING *straighten your* STEAM TRAP PIPING



Anderson Super-Silvertop steam trap with simplified piping. Contrast with puzzle-piping shown above.

● The tangle of old style piping is easy to unravel — just replace those old style traps with modern engineered Anderson Super-Silvertops.

In the past, piping of inverted bucket traps had to be puzzle-piping. Now Anderson Super-Silvertops cut through that jumble — these traps bring streamlined piping to steam trap piping.

Super-Silvertops are connected either as elbow or straight-in-line. No extra fittings to buy or install. Greater capacity by 102% than previous models. Inspected without disturbing pipe connections.

For long life and maximum capacity, no trap excels the Anderson Super-Silvertop line. For economy and clean cut piping, you can't beat Anderson Super-Silvertops. Find out more about them now — write to

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EASY TO INSTALL

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AT LOWEST POSSIBLE COST

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THE PACIFIC LUMBER COMPANY
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Air Conditioning Engineers' Atlas

["Air Conditioning Engineers' Atlas," by Clifford Strock and C. H. B. Hotchkiss. 1st ed. 1939. 76 pp., including 18 colored maps, 9x12 in., stiff binding. Published by The Industrial Press, 148 Lafayette St., New York, N. Y. Price, $2.00.]

This atlas presents in condensed form climatic data used in the solution of heating and cooling problems. It consists of 18 sections, each with a colored map of the United States, accompanied by pertinent tabular data. Nine sections deal with winter weather conditions and nine with summer conditions.

The maps are zoned to show graphically, for all parts of the country, figures on the various phases of weather which are of concern to the heating and air conditioning engineer, while the tables contain supplementary data applying to the larger cities and their environs.

Conventions and Expositions

American Society of Mechanical Engineers: Semi-annual meeting, July 10-15, Fairmont Hotel, San Francisco, Calif. Headquarters office, 29 W. 39th St., New York, N. Y. Papers to be presented include The Economic Thickness of Insulation for Pipes in Intermittent Service, by R. L. Perry and W. P. Berggren; A New Type Orchard Heater, by A. S. Leonard; Performance Characteristics of a Cooling Tower, by A. L. London, W. E. Mason and L. M. K. Boelter; Fundamental Relationships in the Design of Cooling Towers, by G. Russell Nance; and discussions on oil and gas burning.

National Industrial Advertisers Association: 1939 national conference, September 20-22, Hotel New Yorker, New York, N. Y. General chairman, Edward A. Phoenix, Johns-Manville Corp., New York, N. Y.

Exposition of Building, Industry and Services: October 4-6, Hotel Statler, Detroit, Mich. (concurrently with annual convention of Mortgage Bankers Association of America). Secretary-Treasurer, George H. Patterson, 111 W. Washington St., Chicago, Ill.

Joint Meeting, Coal Division AIMME and Fuels Division ASME: October 5-7, Columbus, Ohio. Committee Chairman, R. A. Sherman, Battelle Memorial Institute, Columbus, Ohio.

American Public Health Association: Annual meeting, October 17-20, Hotel William Penn, Pittsburgh, Pa. Headquarters office, 50 W. 50th St., New York, N. Y.

American Society of Mechanical Engineers: Annual meeting, December 4-8, Philadelphia, Pa. Headquarters office, 29 W. 39th St., New York, N. Y.

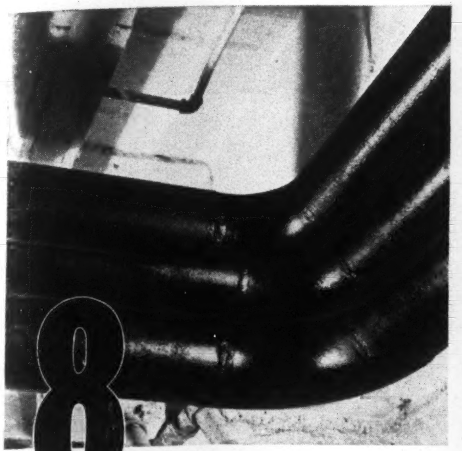
Refrigeration Service Engineers Society: Annual convention, January 15-18, Chicago, Ill. Secretary, H. T. McDermott, 433 N. Waller Ave., Chicago, Ill.

American Society of Refrigerating Engineers: Annual meeting, January 16-19, Blackstone Hotel, Chicago, Ill. Secretary, D. L. Fiske, 37 W. 39th St., New York, N. Y.

American Society of Heating and Ventilating Engineers: Annual meeting, January 22-26, 1940, Hotel Statler, Cleveland, Ohio. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Sixth International Heating and Ventilating Exposition: January 22-26, 1940, Cleveland Public Hall, Cleveland, Ohio. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

National Warm Air Heating and Air Conditioning Association: Annual convention, January 22-24, Hotel Hollenden, Cleveland, Ohio. Managing Director, Allen W. Williams, 5 E. Long St., Columbus, Ohio.



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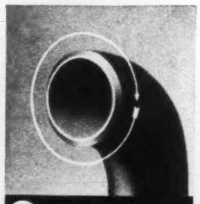
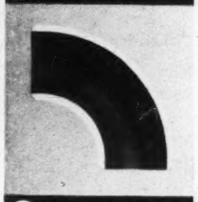


① SEAMLESS



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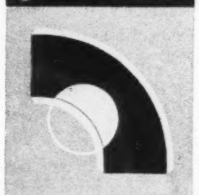

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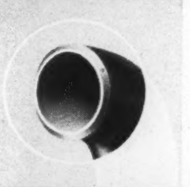

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☐ **Heating & Ventilation**
☐ **Building Estimating**
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TECHNICAL AND INDUSTRIAL SUBJECTS

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☐ Architectural Drafting
☐ Architecture
☐ Auto Elec. Technician
☐ Auto Technician
☐ Aviation Engineering
☐ Boilermaking
☐ Bridge Engineering
☐ Building Estimating
☐ Chemistry
☐ Civil Engineering
☐ Coal Mining
☐ Contracting and Building
☐ Cotton Manufacturing
☐ Diesel Engineering
☐ Electrical Engineering
☐ Electric Lighting
☐ Fire Bosses
☐ Foremanship
☐ Heating
☐ Heat Treatment of Metals
☐ Highway Engineering
☐ House Planning
☐ Machinist
☐ Mechanical Drafting
☐ Mechanical Eng'ring
☐ Patternmaking
☐ Plumbing
☐ Public Works Eng'ring
☐ Radio ☐ Refrigeration
☐ Sanitary Engineering
☐ Sheet Metal Work
☐ Steam Elec. Eng'ring
☐ Steam Engineering
☐ Steam Fitting
☐ Structural Drafting
☐ Structural Engineering
☐ Surveying & Mapping
☐ Telegraph Engineering
☐ Telephone Work
☐ Toolmaking
☐ Ventilation
☐ Welding, Electric and Gas
☐ Woolen Manufacturing

BUSINESS SUBJECTS

☐ Accounting
☐ Advertising
☐ Bookkeeping
☐ Business Correspondence
☐ Business Management
☐ Civil Service
☐ College Preparatory
☐ Cost Accounting
☐ C. P. Accounting
☐ First Yr. Col. Subjects
☐ French
☐ High School Subjects
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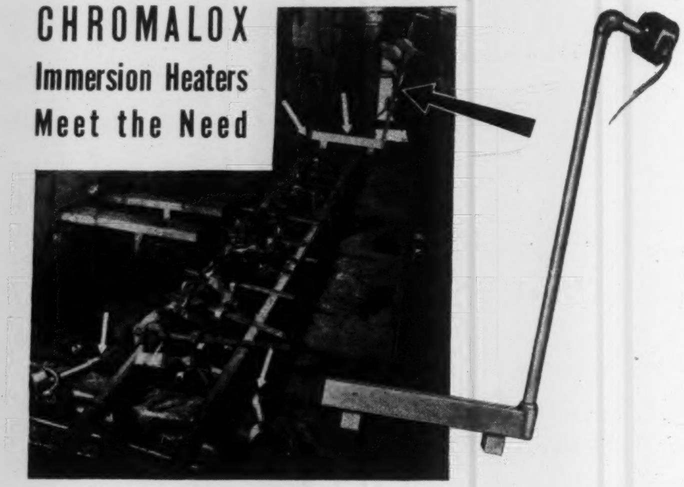
Plating solution temperature held with ELECTRIC HEAT

CHROMALOX
Immersion Heaters
Meet the Need



The exceptionally close automatic regulation of temperature, characteristic of electric heat, is of great value in plating. In the photo above, a chrome plating tank is kept at the ideal working temperature in spite of the fact that the electrical energy used in plating gradually builds up heat, and thus introduces a variable. Four Chromalox electric immersion heaters with lead sheaths, controlled by automatic thermostat and magnetic contactor, assure uniform plating temperature at all times.

Above, one type of Chromalox electric immersion heater. Many other types available, sheathed in various metals required to resist corrosion. Also electric heaters for a wide variety of other industrial uses. Complete catalog upon request. Electric heat experts to help you in any specific problem. Write us.

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Put Your Heat Exchanger Problem up to ADSCO

ADSCO water heater engineers can supply heat exchanger units in storage, instantaneous or special types of heaters to meet the exact capacity and operating conditions required.

Send us the details of your heater problem for recommendations and quotation. Write for a copy of illustrated Bulletin No. 35-75BH and 35-76H on ADSCO Water Heaters.

Some Recent Installations

- Columbia Mills, Minetto, N. Y.
- Commercial National Safe Deposit Co., Chicago, Ill.
- E. I. du Pont de Nemours & Co., Belle, Va.
- Interlake Steamship Co., Cleveland, Ohio
- Germantown Steam Co., Germantown, Pa.
- Ladish Drop Forge Co., Cudahy, Wis.
- Pittsburgh Steamship Co., Cleveland, Ohio
- Sherwin-Williams Co., Chicago, Ill.
- Ohio Power Co., New Philadelphia, Ohio
- Overbrook Steam Heat Co., Philadelphia, Pa.
- University of Wisconsin, Madison, Wis.
- Women's City Club, Boulder, Colo.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 118. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 3191. AIR CONDITIONERS: Carrier Corp., 302 S. Geddes St., Syracuse, N. Y. 4 p. folder on self contained air conditioners for stores and offices, available in nine sizes, describing features and applications.

No. 3192. AIR CONDITIONERS: Trane Co., La Crosse, Wis. 4 p. bulletin (S398) on self contained air conditioners in 3, 5, 7½ and 10 hp sizes.

No. 3193. AIR CONDITIONERS: Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J. 6 p. folder (C-1100-B3) describing features and applications of unit air conditioners for small stores, shops, offices, etc.

No. 3194. AIR CONDITIONING: Frick Co., Waynesboro, Pa. 24 p. booklet describing air conditioning and refrigeration installations in Baltimore and the South, made by the Paul J. Vincent Co.

No. 3195. AIR CONDITIONING: Parks-Cramer Co., 970 Main St., Fitchburg, Mass. Issue of "Parks' Parables" devoted to air conditioning in cotton spinning and featuring adequate humidification and controlled air change.

No. 3196. BEARING BRONZE: Johnson Bronze Co., 460 S. Mill St., New Castle, Pa. 8 p. catalog (L-1) on "Ledaloyl" self lubricating bearing bronze with complete size and price information.

No. 3197. CHECK VALVES: Armstrong Machine Works, 874 Maple St., Three Rivers, Mich. Data sheet on check valves for steam traps for preventing back flow of condensate—for instance, where a trap discharges to an overhead return main—explaining design, construction, advantages and applications.

No. 3198. COMPRESSORS: Trane Co., La Crosse, Wis. 4 p. bulletin (S341) on reciprocating refrigeration compressors, with a cross section view showing construction and a description of design features. Available in single and dual models for various capacities.

No. 3199. CORROSION: Mutual Chemical Co. of America, 270 Madison Ave., New York, N. Y. 12 p. booklet on corrosion in the refrigeration industry, discussing chromate treatment of brine, brine testing, alkalinity, testing for ammonia, preparing new brine, etc.

No. 3200. DUCTS AND DUCT FITTINGS: Milcor Steel Co., S. 41st and Burnham Sts., Milwaukee, Wis. 48 p. catalog (35A) including information on galvanized rectangular pipe and fittings for forced air systems, and other products and accessories.

No. 3201. DUCT FRICTION CHART: Utica Radiator Corp., 2201 Dwyer Ave., Utica, N. Y. Large scale duct friction chart reproduced from ASHVE data, with a table for converting from round to rectangular sizes.

No. 3202. EVAPORATIVE COOLERS: Worthington Pump & Machinery Corp., Harrison, N. J. 6 p. bulletin (S-500-B37) on evaporative coolers for engine jacket water, including description of features, capacity ratings and dimensions.

No. 3203. FANS: Diehl Mfg. Co., Trumbull St., Elizabeth, N. J. 4 p. bulletin on new portable transformer cooling fans for lowering the operating temperature and providing increased transformer capacity.

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A 4½" bellows capable of 1¾" movement; and a 15/32" bellows capable of 350 lbs. pressure per square inch.

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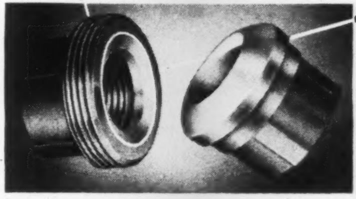

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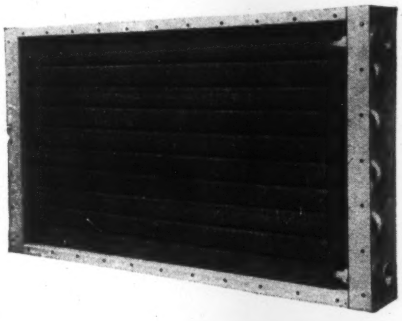

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THE G&O MANUFACTURING COMPANY
New Haven, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States

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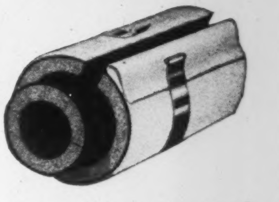
IMPERVO
for ICE WATER PIPES
(Non-Sweat)



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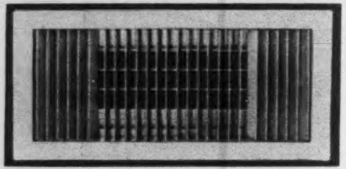

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"Clean-Out" U-Type Model for Accurate Pressure Indication

Meriam U-Type Manometers are preferred by air conditioning engineers because of their unique features of design and construction which insure convenient and inexpensive maintenance. The "Clean-Out" Feature, EXCLUSIVE WITH MERIAM, permits cleaning of the tube without disconnection of piping, and tube replacement without return of gauge to the factory.

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Send for Bulletin No. 1, listing sizes, prices and available scale graduations.

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Instruments for Indicating Pressure or Flow of Liquids and Gases
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No. 3204. FLEXIBLE COUPLINGS: Morse Chain C Turner Pl., Ithaca, N. Y. 32 p. bulletin (57) containing eng neering data, installation and operating information on the man facturer's flexible coupling line, including silent chain couplin roller chain couplings, "Morflex" couplings and universal dri shafts, and radial couplings and universal drive shafts.

No. 3205. GAGES: Manning, Maxwell & Moore, Inc., As croft American Gauge Div., 11 Elias St., Bridgeport, Conn. 32 p. catalog covering complete line of gages for industrial servic including a new laboratory test gage.

No. 3206. HEATING CONTROL: C. A. Dunham Co., 450 E. Ohio St., Chicago, Ill. 4 p. bulletin (613) on the manufacturer's balanced control method of steam heating for apartments, homes and small buildings, describing how the method balances the heat supplied to and lost from a building, and illustrating the parts of the system.

No. 3207. HOT WATER CIRCULATION: Water Service Laboratories, Inc., 423 W. 126th St., New York, N. Y. 2 p. bulletin on hot water circulation describing piping arrangements used in buildings and discussing causes of poor circulation.

No. 3208. METAL SPRAYING: Metallizing Co. of America, Inc., 1351 E. 17th St., Los Angeles, Calif. 26 p. booklet giving details on metal spraying, with pictures and applications and listing the equipment. Also a 4 p. leaflet on a new "Mogul" metal spraying gun using propane.

No. 3209. METHYL CHLORIDE: E. I. du Pont de Nemours & Co., Inc., R. & H. Chemicals Dept., Wilmington, Del. 12 p. reprint on the thermodynamic properties of methyl chloride, by H. G. Tanner, A. F. Benning, and W. F. Mathewson, with tables of properties of the saturated and superheated vapor and a technical discussion.

No. 3210. MOTORS: Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Calif. 2 p. data sheet on new single phase motors, repulsion start, induction run; repulsion induction; and various capacitor types.

No. 3211. PAINTS: New Jersey Zinc Co., 160 Front St., New York, N. Y. 36 p. booklet on improved maintenance of metal surfaces with zinc dust paints, with illustrations and test data.

No. 3212. POWER TRANSMISSION EQUIPMENT: Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill. 272 p. book (1600) on power transmission equipment, containing complete design and application data, dimensions, weights, list prices, and including information on ball and roller bearing units, radial thrust bearings, babbitted bearing units, take-ups, clutches, pulleys, shafting, etc.

No. 3213. REFRIGERATION CONTROLS: Julien P. Friez & Sons, 4 N. Central Ave., Baltimore, Md. 2 p. bulletin (CR) on refrigeration temperature and pressure controls featuring "Hydraulic Action" principle.

No. 3214. REGISTERS AND GRILLES: Air Control Products, Inc., 100 E. Broadway, Muskegon, Mich. 16 p. catalog (39A) on air conditioning registers and grilles, and damper control sets, illustrating and describing various designs and giving information on selection.

No. 3215. REGISTERS AND GRILLES: Hart & Cooley Mfg. Co., 61 Kinzie St., Chicago, Ill. 48 p. catalog and engineering manual (39AC) on air conditioning registers and grilles and damper regulator sets, featuring a technical data section and including information on new registers with turning blade valve.

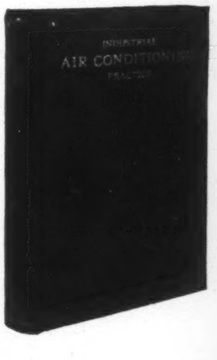
No. 3216. REGISTERS AND GRILLES: Independent Register Co., 3747 E. 93rd St., Cleveland, Ohio. 24 p. catalog (39G) on grilles, warm air registers, cold air faces, and adjustable ventilators, with detailed information on the various types.

No. 3217. TOOLS: Bonney Forge & Tool Works, Tilghman St. & Meadow St., Allentown, Pa. 92 p. catalog (39) covering a full line of alloy steel sockets, wrenches and small hand tools, including several new items.

No. 3218. VALVES: Merco-Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh, Pa. 12 p. bulletin (V-129) on new

"INDUSTRIAL AIR CONDITIONING PRACTICE"

324 Pages—$2.50



A comprehensive treatment of the profitable application of air conditioning in manufacturing processes. Fully describes air conditioning systems operating today in 14 different types of industrial plants. Every engineer, contractor, and salesman interested in this field of air conditioning should own a copy. Remit $2.50 with order.

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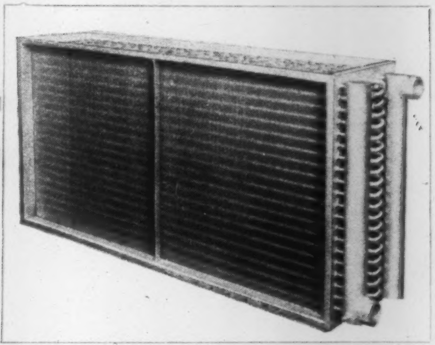
McQUAY Air Conditioning COILS



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For Cooling with Direct Expansion Refrigerants. Equipped with the highly efficient McQuay Distributing Header, insuring proper distribution of refrigerant throughout the coil.

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Designed for Cooling or Heating with water. Give maximum efficiency — counter flow continuous tube, serpentine construction.

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Dependable High Pressure Construction for all applications requiring the heating of air with steam.

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HAIR FELT DUCT INSULATION

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THERMAL CONDUCTIVITY
ONLY **0.246** BTU's

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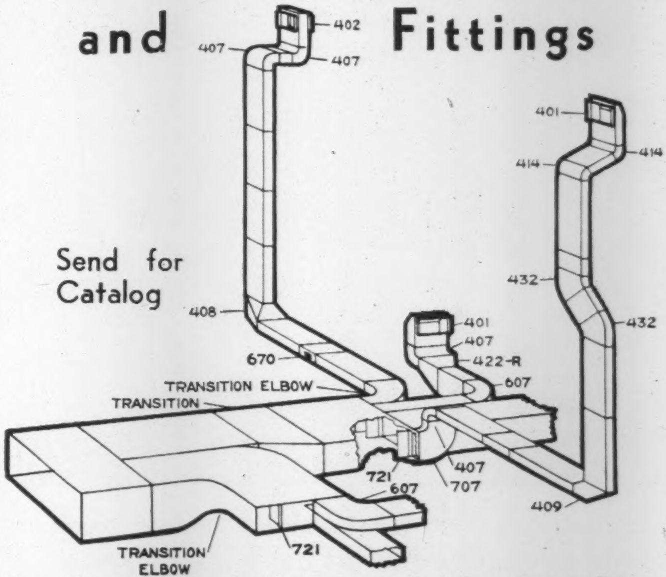
Air Conditioning Pipe and Fittings



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Everything for complete summer and winter air conditioning installations. Made with special Moncrief lock joints. The product of 39 years experience in the manufacture of pipe and fittings. Send for Catalog.

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Heating, Piping and Air Conditioning,
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Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1671	1672	1673	1674	1675	1676	1677
1678	1679	1680				
3191	3192	3193	3194	3195	3196	3197
3198	3199	3200	3201	3202	3203	3204
3205	3206	3207	3208	3209	3210	3211
3212	3213	3214	3215	3216	3217	3218
3219	3220	3221	3222			

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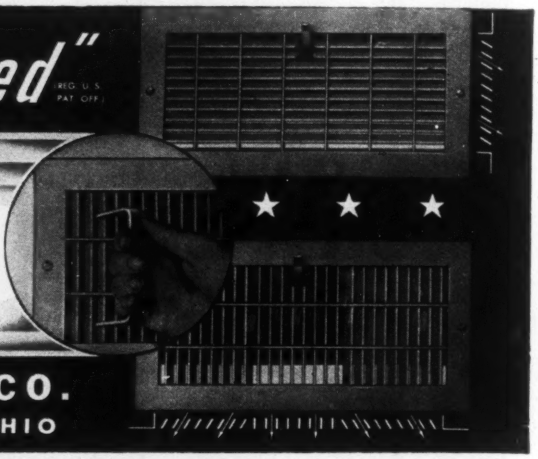
flexible coupling valves with "Sealdport" lubrication, with servi and dimensional data.

No. 3219. VARIABLE SPEED CONTROLS: Columbi Vari-Speed Co., Liberty Bldg., Wheaton, Ill. 8 p. bulletin o "Vari-Speed" controls for use on stokers, conveyors, pumps an production machinery.

No. 3220. VARIABLE SPEED PULLEYS: Speedmaste Co., 1301 Washington Ave., S., Minneapolis, Minn. 4 p. bulleti on variable speed pulleys for standard v-belts with a 6 to 1 rati

No. 3221. WATER HAMMER ARRESTERS: Water Hammer Arrester Corp., West Pierce and Twelfth Sts., Milwaukee, Wis. 8 p. bulletin on "Wacor" water hammer arresters for protecting pipe lines against water hammer pressures and including engineering and installation information.

No. 3222. WATER TREATMENT: Permutit Co., 330 W. 42nd St., New York, N. Y. 4 p. bulletin (2205) on preparation of water for ice making, discussing advantages and equipment.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adjustable DIRECTED AIR FLOW REGISTERS and GRILLES

Every grille bar can be INDIVIDUALLY adjusted either before or after installing. *Send for catalog.*

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THE INDEPENDENT REGISTER CO.
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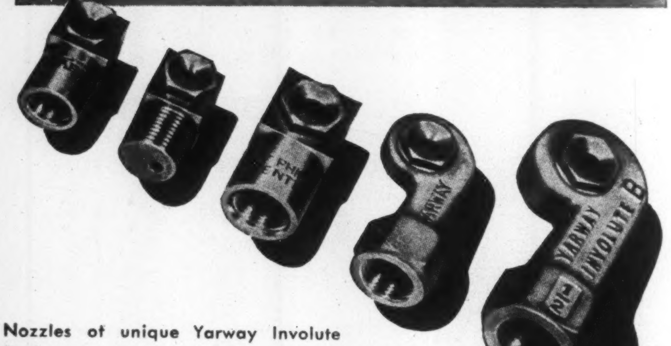
Randall One-Piece Steel Housing Pillow Block

Every user of pillow blocks should learn about this lightweight, quiet, economical, durable, self-aligning and self-lubricating new pillow block. Catalog on request.

Randall GRAPHITE PRODUCTS CORP.
Dept. 710 609 W. Lake St., Chicago, Ill.

AIR CONDITIONING NOZZLES



Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-615.

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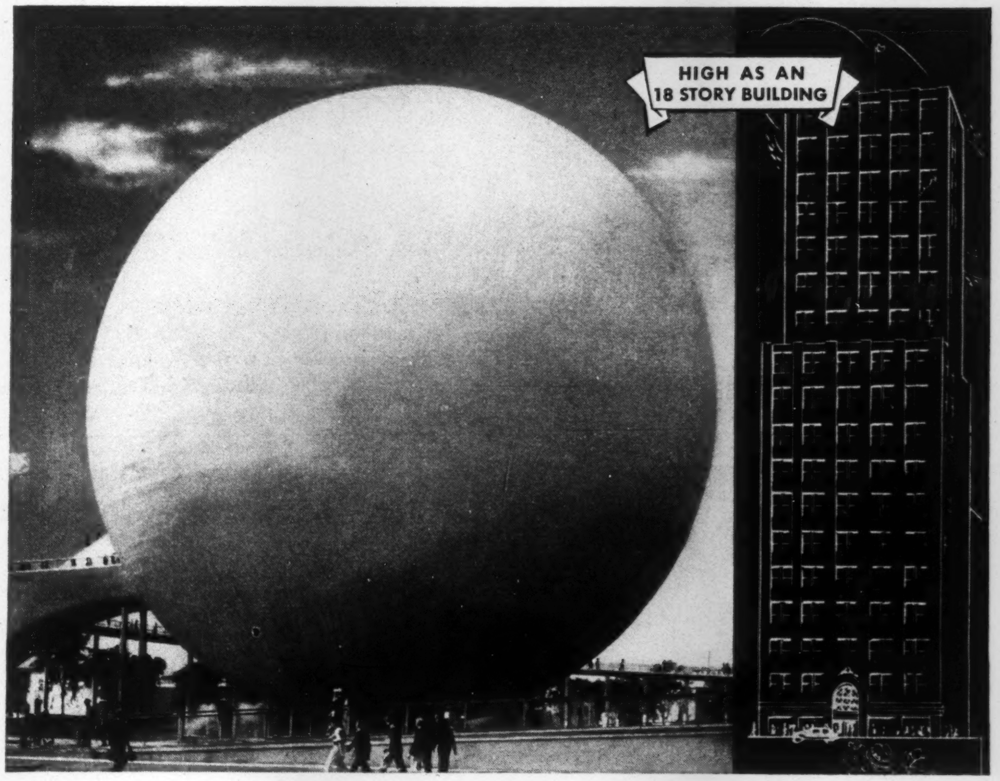
YARWAY

COOLING

BIGGEST MAN-MADE "WORLD" AT NEW YORK WORLD'S FAIR

—with Conditioned Air Circulated by Sturtevant Fans



PERISPHERE! The biggest "world" man has ever built! High as an 18 story building—broad as a city block. Within its interior, which is twice the size of Radio City Music Hall, it houses a model of a mighty Metropolis of the future. Perisphere—Theme Center of the New York World's Fair—is the focal point, the dominant eye-stopping attraction for millions of visitors.

To make certain that the vast multitudes may view this imposing spectacle in comfort, the Perisphere is air conditioned throughout. And the cool, clean, conditioned air—160 tons of it per hour (71,460 c.f.m.)—is circulated by Sturtevant Multivane Fans.

To assure cool comfort, 23 installations at the New York World's Fair are equipped with Sturtevant Air Conditioning or Air Handling Apparatus.

Perisphere, Theme Center of New York World's Fair, is equipped with a Worthington-Carbondale Air Conditioning System, installed by Carbondale-New York Company.

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Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

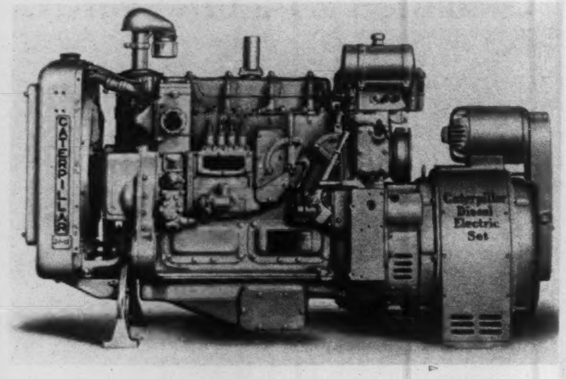
WORLD'S LARGEST MAKER OF AIR HANDLING EQUIPMENT

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 110. Add the new products and companies listed here to your Directory Section which you received in your January, 1939, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Diesel Electric Sets for Air Conditioning

No. 1681—Two new self-contained diesel electric sets are designed for application to small air conditioning plants. They are also suitable for dairies, creameries, and cold storage plants of all sorts.

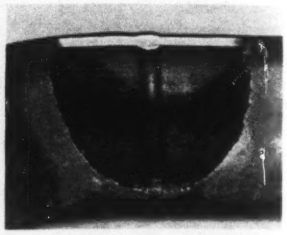


The only wire connections to be made are from the generator terminal to the circuit breaker, and from the circuit breaker to the distribution box. No special bases are needed. The engines have but three operating adjustments, none of which involves the diesel fuel system. The generators are of single unit construction, equipped with ball bearings, which require lubrication only once in six months. Built-in regulation enables the sets to pick up relatively large motor loads with little light flicker and voltage drop, the maker states.

Two sizes are available. One is supplied in 3 phase, 110, 220 or 440 volts at 15 kw, 0.8 power factor, and is also available as single phase, 110/220 volts, three wire type, and 110 and 220 volts two wire type at 13 kw, 0.8 power factor. The other is supplied in 3 phase, 110, 220, or 440 volts, at 20 kw, 0.8 power factor, is also available in a single phase, 110/220 volts, three wire type, and in a 110 and 220 volts, two wire type at 18.5 kw, 0.8 power factor.—Caterpillar Tractor Co., 600 W. Washington St., Peoria, Ill.

New Welding Fitting

No. 1682—A new seamless forged steel welding fitting features an annular lip which is forged integral with the fitting. By firmly centering the fitting in the pipe to which it is to be welded, the lip eliminates the need for backing rings, clamps and guides for holding the fittings in position, and is said by the manufacturer to simplify and expedite pipe welding. The feature is patented, and the fittings having this self-centering lip or ring are known as "Centring Weldells."



Particular emphasis is placed by the manufacturer on the fact that the ring remains cooler during the welding than the molten weld metal. As a result, the bottom of the V appears darker than the sides. This color contrast is said to be an ideal guide to the welder, permitting

HOLD EVERYTHING

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DR = Day Letter
NR = Night Letter
C = Cable
CNR = Cable Night Letter
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HOLD EVERYTHING. PLACE NO STOCK ORDERS UNTIL
YOU SEE IMPORTANT DOLE ANNOUNCEMENT REGARDING
BETTER AIR AND VACUUM VALVES AT ATTRACTIVE PRICES.

THE DOLE VALVE COMPANY

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Complete New Line
AIR & VACUUM VALVES

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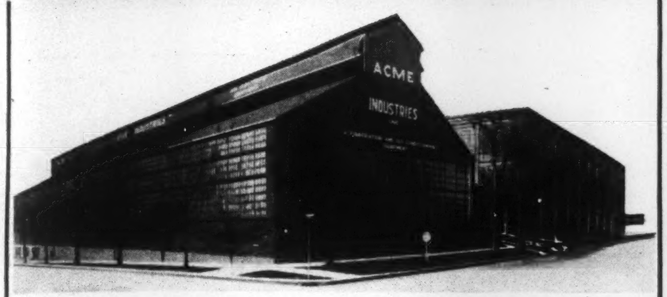

AIR CONDITIONING EQUIPMENT

It is possible that you are not protecting your own interests if you fail to learn of the advantages presented by the use of

ACME PRODUCTS

◆

SHELL AND TUBE WATER COOLERS
FLOODED

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EVAPORATIVE CONDENSERS

SPECIAL FINNED COILS

PIPE COILS

OIL SEPARATORS

HEAT INTERCHANGERS

COMFORT COOLING UNITS
COLD WATER AND REFRIGERANT GAS

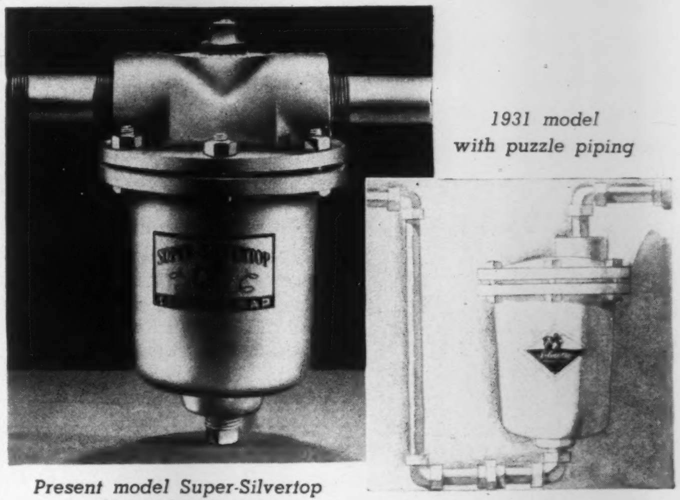
Write for literature.

ACME INDUSTRIES, Inc.
JACKSON - MICHIGAN
U. S. A.

EXPORT DIVISION
116 BROAD ST., NEW YORK CITY

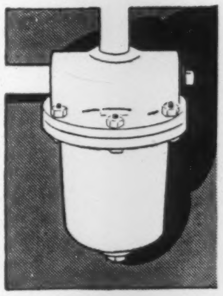
● SIMPLIFIED PIPING

the result of 53 YEARS' PROGRESS



1931 model with puzzle piping

Present model Super-Silvertop with simplified piping



Super-Silvertop installed as an elbow

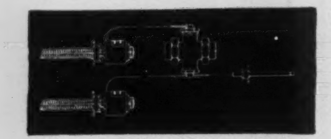
● Yes, the 1931 model Anderson steam trap was a good trap—but 53 years of research and experience pointed the way to progress. The present model Anderson Super-Silvertop brings simplified piping. It makes our old style trap with its puzzle-piping not only wasteful but obsolete.

This modern Super-Silvertop trap simplifies steam trap piping with a saving of fittings and labor. In fact, users report a saving of as many as 13 fittings and from 40 to 60 minutes of time on every trap installed. It has the further advantage of 102% increase in capacity over the previous model Anderson trap. Users not only have a choice of elbow or straight-in-line connection but a trap that is easy to inspect without disturbing pipe connections. In addition, guided bucket insures longer bucket life, and bored passages of liberal area prevent clogging with scale.

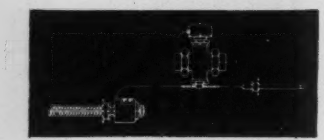
Our engineering department is constantly working to improve the Super-Silvertop line even more. Further improvements are sure to come, for the Anderson Company intends to lead the field in *more* progress in steam traps in the years ahead. Have all the facts at your fingertips . . . write today for complete information.

THE V. D. ANDERSON COMPANY
1949 WEST 96th STREET • CLEVELAND, OHIO

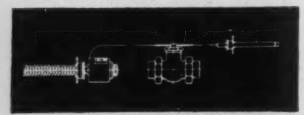
Sylphon Means Simplicity IN AIR CONDITIONING Control



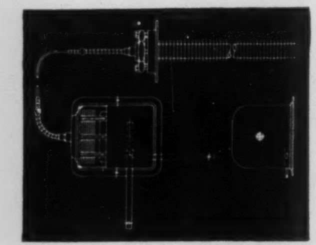
Sylphon No. 889-C Modulating Dual Control. Regulates Room temperature from temperature of re-circulated air and offers compensated control of minimum discharge air temperature. (This control can be furnished to raise its setting at predetermined rate with falling outside temperatures.)



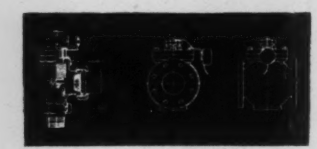
Sylphon No. 889-EC Dual Control. Regulates room temperature from wall thermostat and acts as compensated low limit ductstat to maintain even minimum discharge air temperature. (Compensated ductstat can be furnished to raise its setting at predetermined rate with falling outside temperatures.)



Sylphon No. 928-CC Modulating Control regulates air stream temperatures from compensated duct thermostat (which can be furnished to raise its setting at a predetermined rate with falling outside temperatures).



Sylphon No. 15-F Modulating Damper Motor for control of Mixing dampers.



Sylphon No. 890 Control for regulating direct radiation from wall thermostat. Applicable both to individual radiators and to zone control.

Many engineers and architects are discovering that air conditioning control need not be a complicated and expensive problem. In fact, they have found that dependability in a control instrument is directly related to its simplicity of design—and are selecting Sylphon for low-cost, long-lived, dependable control.

Each Instrument a Complete, Self-Contained Unit—Sylphon Control Instruments are self-contained and self-sufficient—literally "powered by the temperatures they regulate". They need no expensive and complicated auxiliary equipment to make the system work.

Offer Automatic MODULATING Control—Sylphon Control Instruments are unique in that they provide MODULATING Control which prevents cyclic operation with its alternately "too hot"—"too cold" — "too dry" — "too humid" conditions and objectionable drafts. Hence they assure constant, healthful, pleasant conditions in the controlled area at all times.

Moderate Cost—Sylphon Instruments are moderate in first cost, extremely low in operating cost, and require practically no maintenance.

Proven Through 35 Years of Hard Service—Sylphon Control Instruments are the products of the originators, pioneers and world leaders in "self-contained" control equipment. The soundness of their fundamental principles of design and construction has been proven through 35 years of hard industrial control service where more than 250,000 successful installations have been made.

A Nation-Wide Organization—The Fulton Sylphon Company maintains a nation-wide organization of experienced control specialists to cooperate with you in the solution of your control problems. 'Phone the office nearest you, or write for Bulletin PE-820.

"SYLPHON MEANS SIMPLICITY IN AIR CONDITIONING CONTROL"

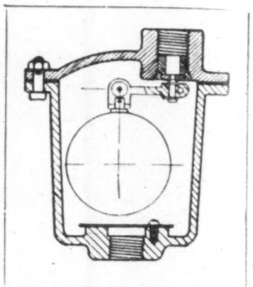
FULTON
Sylphon
FOR
TEMPERATURE
CONTROL

THE FULTON SYLPHON CO.
KNOXVILLE, TENNESSEE
Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England

him to obtain complete penetration without burning through. Attention is also called to the smooth contour formed by the streamlined lip which minimizes flow resistance.—Taylor Forge & Pipe Works, P. O. Box 485, Chicago, Ill.

New Air Release Valves

No. 1683—A new line of air release valves automatically rid pipe lines and other closed vessels of entrained air or other gas. There are three different styles: (1) the standard "Silvertop" in six sizes from ½ to 2 in. inclusive for pressures up to 250 lb per sq in.; (2) the forged steel style for use on high pressures up to 1000 lb per sq in. and made in three sizes with pipe connections of ½, ¾, 1, 1¼, 1½, and 2 in.; and (3) the "No. 0," made in the ¾ in. size only for a maximum pressure of 150 lb per sq in.

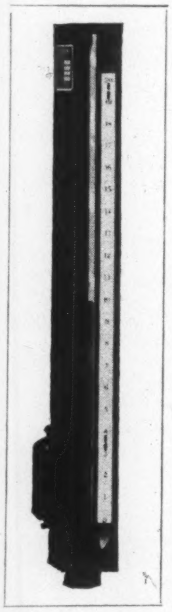


The valve consists of a valve and seat, a lever and a ball float inside of a case. The inlet is at the bottom and the air vent is at the top. The liquid raises the float, and holds the valve closed (a liquid is necessary to actuate the float; steam or other gases will not). An accumulation of air or gas lowers the liquid level, causing the float to drop. This opens the valve and vents the air or gas.

In operation, these valves are placed at the high points in the pipe line where the accumulations of air are automatically vented, to eliminate air binding. Other applications include hot water heating systems, water mains, brine lines, and for releasing air or gas from other liquid lines and tanks under pressure. —The V. D. Anderson Co., 1949 W. 96th St., Cleveland, Ohio.

Tubeless High Pressure Manometer

No. 1684—A well type manometer constructed on a new principle which makes it suitable for very high pressure has a heavy, heat treated glass bar backed by a stainless steel backing bar which contains an accurately machined groove for the liquid column, instead of a glass tube. Two channels, milled from solid steel bars, surround the backing bar and enclose the glass except for a space in the front where the reading is taken.



Originally designed for use with high pressure boilers, this manometer is equally useful for any high pressure application, the maker states. The manometer is tested at a hydraulic pressure of 4000 lb per sq in.

Standard models range in size from 15 through 40 in. In each of the sizes the indicating column is of one unbroken length, unobstructed by tie bars or glass ends. Water, red oil or mercury may be used as indicating fluids. Available accessories include an all steel control valve assembly with piping, and a return well.—The Meriam Co., 1955 W. 112th St., Cleveland, Ohio.

Adds Thermal Anemometer

No. 1685—A new "Thermo-Anemometer" is the latest addition to the maker's line of instrument-tools. It is an electrical instrument for the measurement of air velocities over a range from 10 to 6000 fpm. It is accurate at extremely low velocities.

Randall One-Piece
Steel Housing
Pillow Block

Your *customers* benefit when *you* use *Randall* pillow blocks

- Quiet
- Durable
- Low-Priced
- Self-Aligning
- Self-Lubricating
- Large Oil Capacity

A third of a century of bearing engineering

Write for catalog describing the complete Randall line of pillow blocks.

Also manufacturers of Graphite Bronze Bushings in all sizes.

Representatives carrying stocks

TEK BEARING CO.
177 Lafayette
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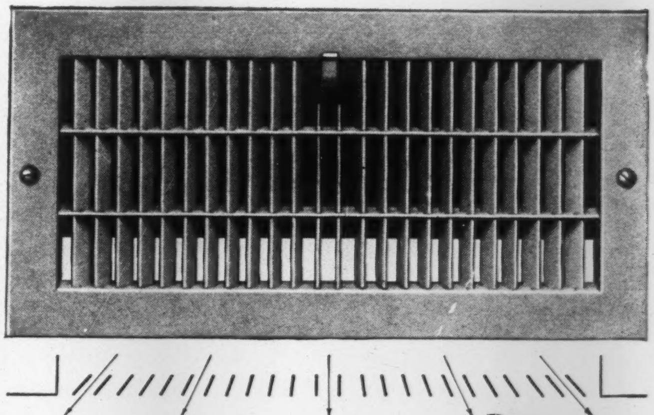
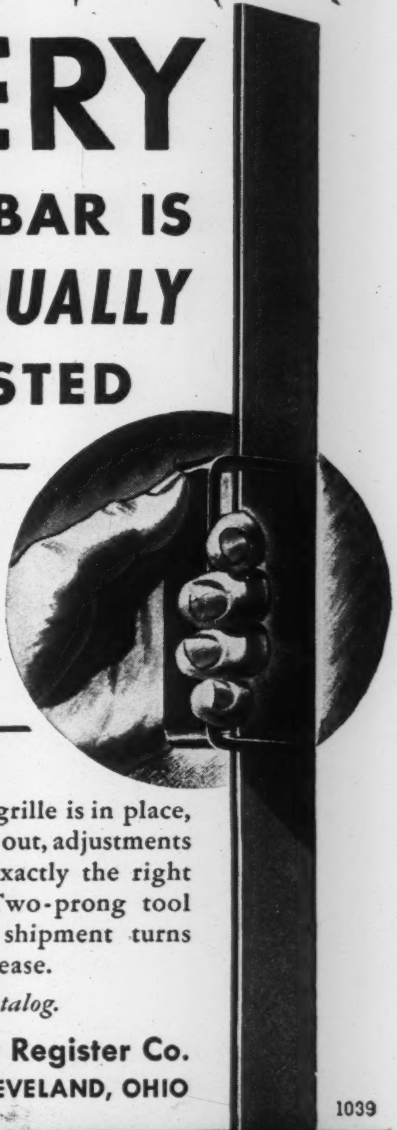
AMERICAN STOCK GEAR CO.
100 St. Clair Ave., N. W.
Cleveland, Ohio

C. W. MARWEDEL
San Francisco
California

Randall GRAPHITE PRODUCTS CORP.
Dept. 810 609 W. Lake St., Chicago, Ill.



EVERY GRILLE BAR IS *INDIVIDUALLY* ADJUSTED



Air flows can be deflected right or left, up or down . . .

After the register or grille is in place, and without taking it out, adjustments can be made until exactly the right result is achieved. Two-prong tool accompanying each shipment turns the grille bars with ease.

Send for catalog.

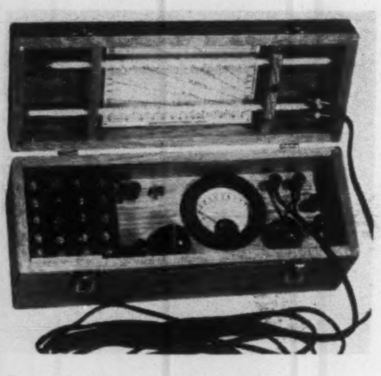
The Independent Register Co.
3747 E. 93rd ST., CLEVELAND, OHIO

1039

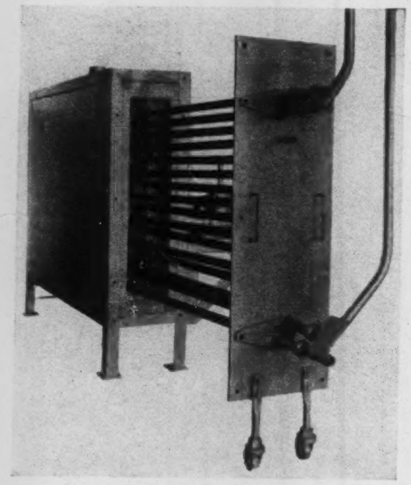
INDEPENDENT

"FABRIKATED" *Adjustable*
DIRECTED AIR FLOW
REGISTERS and GRILLES

the maker says, and is suitable for either field or laboratory use in open air, in front of grilles or registers and in ducts.



The instrument is housed in a polished oak carrying case ($13\frac{1}{4}$ x 5 x 5 in.) with chromium plated hardware, and weighs 7 lb complete with battery.—Julien P. Friez & Sons, Inc., 4 N. Central Ave., Baltimore, Md.



Process Steam Superheater

No. 1686—This new superheater for steam used in industrial processing has a new type of burner, employing gas fuel which applies heat to a maximum area of the steam coil in order to produce rapid transfer of heat to the steam with the result that the steam is superheated as used and steam storage is unnecessary.

The burner operates through a wide range of adjustment in the rate of fuel supply, permitting a desired steam temperature to be maintained automatically and accurately for various rates of steam demand, the maker states.

The illustration shows a superheater with the steam coil withdrawn for inspection. The burner, located in the base, employs a special refractory material, excluding metal burner parts from the heating zone. The unit illustrated raises the temperature of steam incoming at 350 F to 750 F with maximum temperature of 900 F. Outlet pressure is the same as the inlet pressure. The maximum demand rate is 3000 lb per hr of steam. Maximum operating temperature is reached within 5 min from the time of lighting the burner.—Selas Co., 18th St. at Indiana Ave., Philadelphia, Pa.

Electric Heater for Room Coolers

No. 1687—A demand to extend the benefits of portable room air conditioners to provide heating in connection with ventilation has been met by the development of an electric strip heater for use with the maker's ¾ ton room cooler. The heaters will be available in 220 volt a-c and 230 volt d-c characteristics, 1500 watts capacity and for use with self-contained thermostatic control. They will be made for factory or field installation.

With the addition of the heater, the conditioner will utilize the air filtering, circulation and ventilation features to distribute the warmed air to all parts of the room and to provide any desired amount of outside air. The smoke exhaust will also operate year 'round to dissipate smoke and odors.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

New Propeller Fan

No. 1688—A new propeller-type fan blower with the motor on top of the housing out of the air stream has been designed

"YOU'RE SURE of QUIET and FIRE-SAFETY...THOSE DUCTS ARE LINED WITH J-M AIRACOUSTIC SHEETS"

NOISY air-conditioning ducts can be annoying . . . and ducts that are lined with combustible materials present a definite hazard. Yet you can avoid both of these dangers . . . assure complete customer satisfaction . . . by installing ducts lined with J-M Airacoustic Sheets.

This modern duct lining absorbs more than 70% of all sounds in the duct. Basically mineral in composition, Airacoustic Sheets will not contribute to the spread of fire. And, being highly moisture resistant, they provide maximum protection against damage caused by excessive humidity.

In addition, Airacoustic Sheets are strong and durable, yet light in weight. Easy to apply and handle, they make good-sized reductions in installation costs. For full details, write Johns-Manville, 22 East 40th St., New York, N. Y.

NO FIRE HAZARD or complaints about noisy ducts when you use J-M Airacoustic Sheets for linings. This basically mineral lining will not contribute to the spread of fire . . . absorbs more than 70% of all sound in the ducts.

JM Johns-Manville
AIRACOUSTIC SHEETS
FOR DUCT LININGS

A "Package" Item—
Large Unit Sale—An
Ever Widening Market—
You Have all This with The

CURTIS
STORE and OFFICE
COOLER!

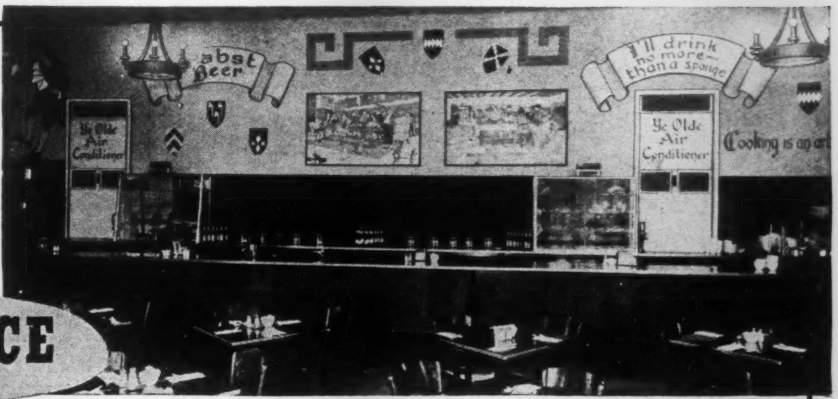


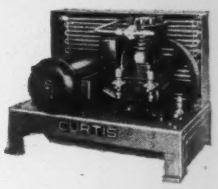
ILLUSTRATION shows two Curtis Store and Office Coolers in the Canterbury Inn at the Merrie England Village, New York World's Fair 1939. This is only one of the countless applications for which this latest addition to the Curtis line of Refrigeration and Air Conditioning Equipment is ideal.

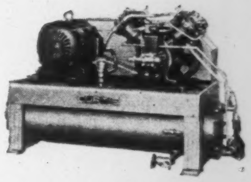
When you sell the Curtis Store and Office Cooler, you open up a vast new market for greater sales and profits. All classes of retail establishments, chain stores, offices, restaurants, banks and many, many others are demanding air conditioning. It has become a necessary factor in successful merchandising and efficient office work.

It's a handsome, complete, factory designed, packaged air conditioner. Mechanically cools, dehumidifies, circulates and filters the air — adaptable for heating — easily and quickly installed and semi-portable. 3 and 5 ton sizes.

The Curtis line of Condensing Units includes sizes from 1/6 to 30 H.P. air and water cooled. Every Curtis product is precision engineered to deliver economical, efficient, care-free performance throughout an exceptionally long life.

If you're interested in profits, in increasing your sales, write to Curtis for complete information — today.

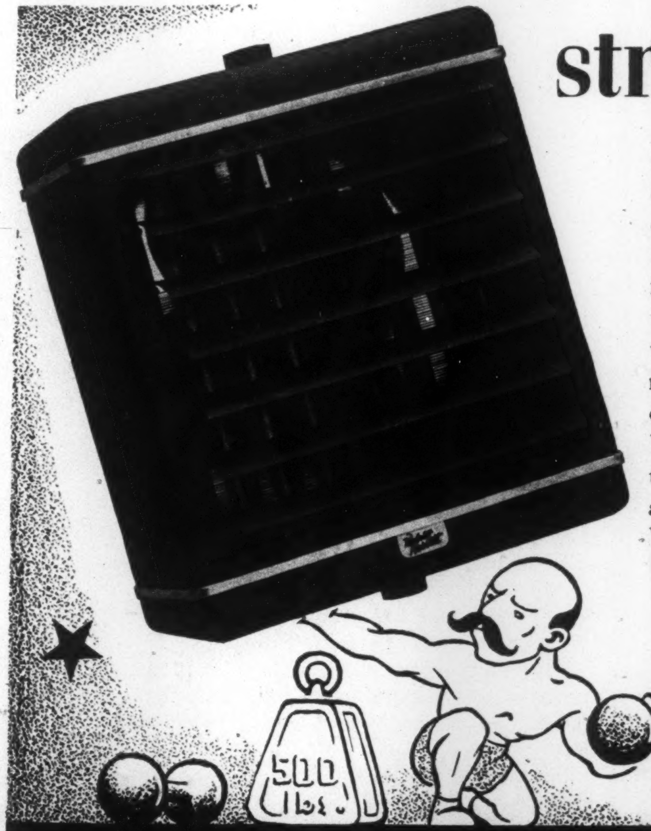




45 Air Cooled Units—42 Water Cooled Units 1/6 to 30 H. P.

CURTIS
REFRIGERATION
AIR CONDITIONING AND COMMERCIAL

CURTIS REFRIGERATING MACHINE CO.
Division of Curtis Manufacturing Co.
1950 Kienlen Avenue St. Louis, Missouri



strong on quality...

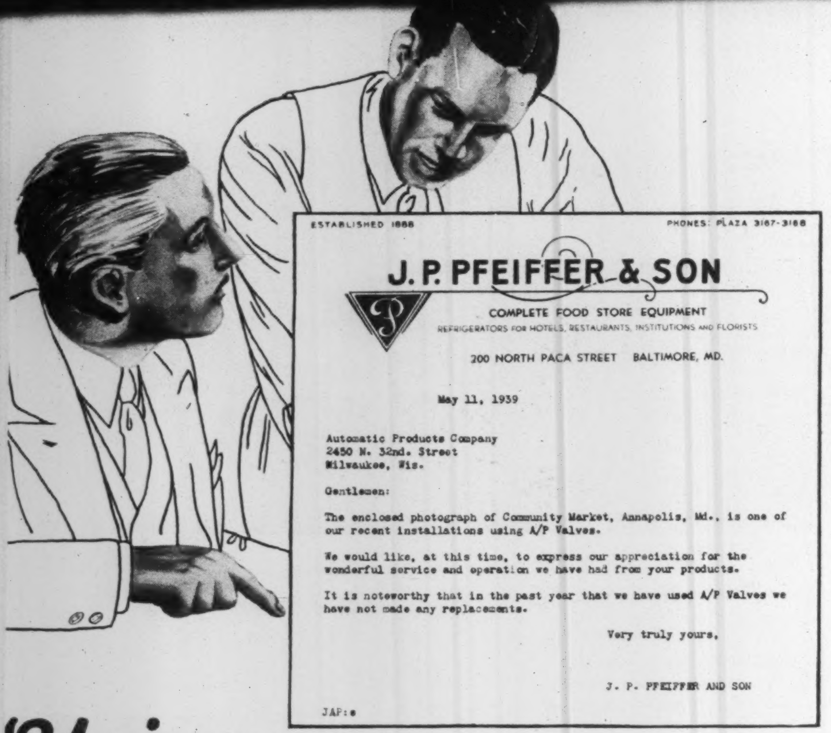
Endurance of the Webster-Nesbitt Unit, like the strong man's, comes from years of training, plus inherent *quality*. Trained engineers and craftsmen build Webster-Nesbitt Units, using the highest quality materials. The copper tube-and-fin heating elements are guaranteed for working steam pressures up to 150 pounds per square inch. The fans have exceptionally wide, overlapping blades of gradual pitch. The motors are rubber-isolated, quiet operating. The heavy furniture steel casings are die-formed and sturdily welded. And since Webster-Nesbitt Units operate according to the large-air-turnover, low-temperature-rise principle, their *low cost*, is another strong point in their favor. Consult the nearest Webster representative.

CATALOG ON REQUEST

WEBSTER-NESBITT GIANT HEATERS *are available in floor, wall, ceiling and inverted types. Giants of endurance and performance, for extra large interiors. Send for new catalog.*

Webster Nesbitt
UNIT HEATERS

Manufactured by JOHN J. NESBITT, INC., Holmesburg, Phila., Pa.
Distributed Exclusively in the U. S. A. by WARREN WEBSTER & COMPANY, Camden, N. J.
Address Nearest Webster Sales Office—Consult Your Telephone Directory



ESTABLISHED 1888 PHONES: PLAZA 3187-3188

J. P. PFEIFFER & SON
COMPLETE FOOD STORE EQUIPMENT
REFRIGERATORS FOR HOTELS, RESTAURANTS, INSTITUTIONS AND FLORISTS
200 NORTH PACA STREET BALTIMORE, MD.

May 11, 1939

Automatic Products Company
2450 N. 32nd. Street
Milwaukee, Wis.

Gentlemen:

The enclosed photograph of Community Market, Annapolis, Md., is one of our recent installations using A/P Valves.

We would like, at this time, to express our appreciation for the wonderful service and operation we have had from your products.

It is noteworthy that in the past year that we have used A/P Valves we have not made any replacements.

Very truly yours,

J. P. PFEIFFER AND SON

JAP:e

'Using AP VALVES a *Whole Year* without *Any Replacements"*

...Typical of A-P Valve efficiency and accuracy.

xceptional records of Valve Dependability re commonplace when A-P Valves are sed on ALL your Refrigeration and Air onditioning installations. Check into any ob using A-P Valves—talk to the Engi-eers responsible for the work—you never ind a bit of service trouble traceable to alve failure!

his is the kind of service efficiency that akes an installation profitable to you— nd completely satisfactory to your cus-omer. That's why Refrigeration Service ngineers swear by A-P Valves—call them reat "Reputation-builders."

Installation
Community Market
Annapolis, Md.
Refrigeration Equipment
Brunner and Kramer

Cases
Gloekler Mfg. Co.
Erie, Pa.

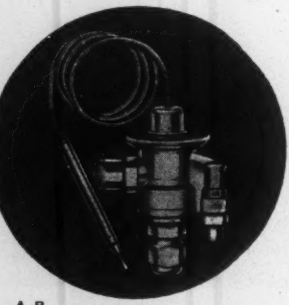
Installed by
J. P. Pfeiffer & Son
Baltimore, Md.

Jobber
Baltimore Refrigeration
Supply Co.

Valves
A-P Thermostatic
Expansion Valves

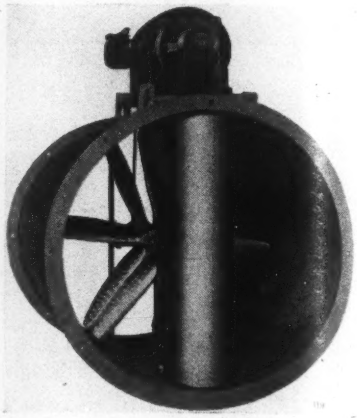
AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN

● Refrigeration Parts Jobbers, Who Recognize Quality, Stock A-P Controls



A-P Model 207 Thermostatic Expansion Valve

EPENDABLE
THE BYWORD FOR A-P VALVES



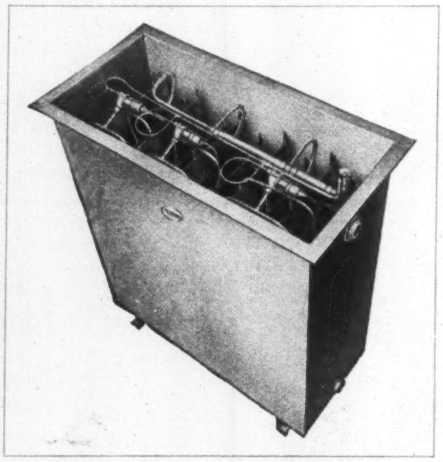
for moving air at high temperatures, or in which the presence of acids or other elements might damage the motor.

One side of the motor platform is hinged, and lock bolts on the opposite side can be adjusted to tighten or loosen the V belt or to change it. Patented "Charavay Tear Drop" propellers are incorporated in the design to give high air deliveries against heavy back pressure, the maker states.

The blower is delivered complete with housing, and can be installed in existing ducts. It is made in 12 standard sizes, with propellers from 18 to 48 in. in length, and can be built in other sizes to meet special needs.—Hartzell Propeller Fan Co., P. O. Box 909, Roosevelt Ave., Piqua, Ohio.

Accumulator Stores Cooling Effect

No. 1689—A new "cold accumulator" permits the storing up of cooling effect in an especially designed tank containing copper plate coils, upon which a thin coating of ice is formed. Built in capacities up to 1,000,000 Btu, it is recommended by the manufacturer for use in connection with heavy air conditioning loads of short duration, such as found in churches, clubs, theaters, mortuaries, exhibition halls, etc. Refrigerating effect may be stored during off peak operation at night.

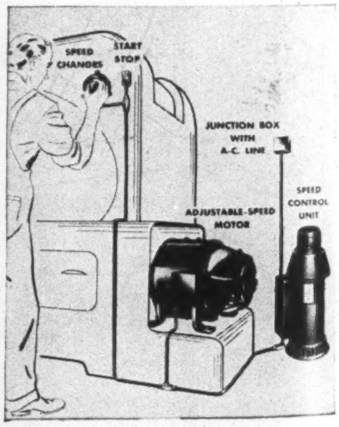


These units employ "Freon-12" or methyl chloride refrigerants. They are built up of copper plates to which copper tube primary surface is attached and groups of these plates, spaced properly, form a section. One thermal expansion valve is used for each section.—McQuay, Inc., 1600 Broadway, N. E., Minneapolis, Minn.

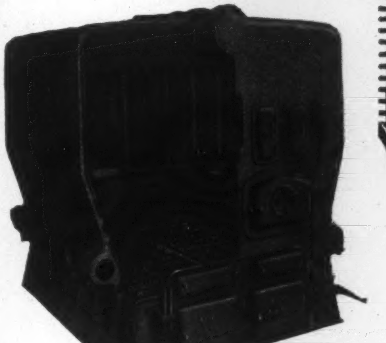
All Electric Adjustable Speed Drives

No. 1690—The "VS" drive is a recently announced all electric adjustable speed drive for alternating current circuits which applies a principle of speed control used for large units to small units (1 hp and up). The control unit comprises elements common to the ordinary squirrel cage motor and d-c generator and it can be mounted anywhere.

Three wires from the power circuit are connected to the control unit and from the control unit wires are



You can slip one of the twin sections through most any decent size door, and even some what are a bit skimpy.



Hank

Sez—

Put In a Burnham Twin and You'll Save Put Outs

Now I been a tellin' you fur a long time, the *more* things about our cast iron twin sectional boilers.

Now it's high time ter talk about the *less* ones.

First there's the less *put ins* and *put outs.* There's *less labor* puttin' 'em in. No big tackle. No big hole has ter be left to do it. No part of the Big Twin is so big it can't be slipped through any man sized doorway.

Then there's *less labor* taking 'em out. *Less,* because you don't need ter take 'em out fur maybe 20 or 30 years, which is long enuff.

Then there's *less labor* taking care of 'em. No tubes to be yanked out and put in. Besides which, there's *less room* taken in the basement, as no space is needed at front or rear, fur flue cleaning.

You can snug it plumb up in a corner if you want ter, saving a whole passel of space by it.

Furthermore, you can have it furnish the hot water supply in the latest tankless fashion. You don't need to use a steel boiler jist because of that Tankless heatin'.

That's a thing of the past.

So ter my notion, am doing you a favor in callin' your attention ter the *less* things about this Burnham Big Twin Cast Iron Boiler instead of poundin' the table so alfired hard about the *more* ones.

It's a case where maybe the *less* is *more than the more.*

Which sound Irish but is really Checkoslayvackia.

HANK HINDLE

Burnham Boiler Corporation
Manufacturers of Heating Equipment Since 1873
IRVINGTON, NEW YORK ZANESVILLE, OHIO
Export Dept.: 116 Broad Street, New York

Burnham Boiler

MARLEY Cooling Towers Cost Much Less BECAUSE they are Extra-Quality-Built for Better Performance

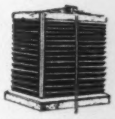
"Sure, I had water cooling equipment quoted at lower prices on each of the last five towers we've bought from MARLEY. But all our Marley Towers are still in operation and giving us steady, dependable cooling water temperatures and flexible controlled operation without bother or expense.

"*That's* what I mean.

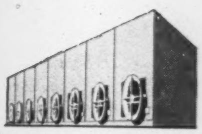
"Purchase price—or *first cost*—doesn't fool me. That's only a small part of *ultimate cost.* In the long run you've got to figure upkeep, operating cost and plant inefficiencies or repairs chargeable to unsatisfactory cooling water conditions or temperatures.

"Yes, outright we did pay a very little more than the lowest price for MARLEY equipment, but we've paid much less over all. MARLEY economies out-strip them all and far out-last them. Every MARLEY job was *individually engineered* to our exact needs by men who *know how* from long and wide experience—manufactured and installed by the old reliable leader in the water cooling field."

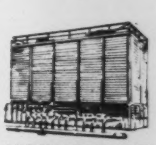
New Models at New Savings!



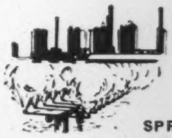
SPRAY TOWERS and SPRAY-COIL TOWERS



FORCED DRAFT TOWERS

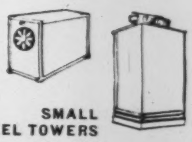


INDUCED DRAFT TOWERS



SPRAY PONDS

The Marley line for 1939 presents latest improvements in a wide diversity of types at the lowest prices in Marley history.



SMALL STEEL TOWERS

The MARLEY Company
Fairfax and Marley Roads, Kansas City, Kansas
Sales Offices or Agents in Principal Cities

Streamaire Copper Convectors

DIAGNOSTIC BUILDING PEORIA STATE HOSPITAL, PEORIA, ILLINOIS
Heating Contractor: Carson and Payson, Danville, Illinois

Cleanliness, even heat and air circulation are requisites in hospital heating systems provided by YOUNG STREAMAIRE Convectors.

The Diagnostic Building of the Peoria State Hospital, like many other similar institutions, is heated with YOUNG STREAMAIRE Convectors. Both wall hung and recessed type enclosures are used.

Architects, engineers, and heating contractors, when specifying YOUNG STREAMAIRE Convectors, have much to offer building owners in appearance and performance.

YOUNG RADIATOR COMPANY
RACINE, WISCONSIN

Young Quality

Make
HUSSEY
YOUR HEADQUARTERS FOR
COPPER
IN EVERY COMMERCIAL FORM

Rolled and finished in one of the finest equipped rolling mills in the United States from Pure Lake Copper, Hussey is the ideal copper specification for all air conditioning installations where corrosion-resistance, permanence and ease of fabrication are important factors. It will pay you to investigate the convenience and advantages of dealing direct with your Hussey Warehouse or District office.

See the Educational Exhibit of Copper and Brass Industry, Metals Building at the World's Fair.

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C. G. HUSSEY & COMPANY
(Division of Copper Range Co.)
Rolling Mills & General Offices: Pittsburgh, Pa.
Warehouse Stocks in the Principal Cities

Hussey Pure Lake Copper Sheets, Rolls and Tubing for every corrosion-resistant application including Air.Washers, Blowers, Coils, Ducts, etc.

Copper HUSSEY *Brass*

run to the driving motor and the operator's station. The motor is designed particularly for adjustable speed service. Connection to the driven machine may be by any of the methods regularly used for motor drives.

Speed of the motor is adjusted by turning the handle of the speed adjuster, and the motor may be stopped and started without interfering with the speed setting. For tandem drives, the speeds of two or more motors can be changed in unison when operated from a single control unit.—Reliance Electric & Engineering Co., Ivanhoe Rd., Cleveland, Ohio.

Chipping Hammer and Wire Brush for Welders

No. 1691—A convenience tool for welders is the "Triplex" welders' chipper. It consists of a drop forged steel chipping hammer with hardwood handle, having a heavy duty wire brush rigidly mounted on the top side.

The hammer chisel chips and breaks the scale, and then the tool is turned in the hand and the brush is used to clean the surface.—St. Pierre Chain Corp., 54 Frank St., Worcester, Mass.

Book Reviews

Summer Weather Data

["Summer Weather Data—with Design Data, Statistics, Charts, Maps and Technical Analysis," compiled and edited by J. C. Albright, vice-president, The Marley Co. 1st ed. 1939. 165 pp., 8½x11 in., with 18 full page maps, fabrikoid binding. Published by The Marley Co., Fairfax and Marley Rds., Kansas City, Kans. Price, $3.00.]

This book represents the culmination of efforts occupying a great part of the author's time during the past eight years. It contains a great deal of data not obtainable elsewhere and is of significance to engineers because it presents a strictly engineering interpretation of weather data. It is of interest to all industrial engineers, but particularly to those in air conditioning and refrigeration.

Chapters are included on the atmosphere and climate, the U. S. Weather Bureau, factors influencing summer weather, analysis of summer weather data, application of data in design, dry bulb temperatures, wet bulb temperatures, dew point temperatures, wind data and sunshine data.

The publishers will welcome letters from engineers interested in this book and offer in response a copy of a bulletin which contains a sample chapter, a detailed description of its contents, and wet bulb, dry bulb, and dew point maps.

Pipe Corrosion and Coatings

["Pipe Corrosion and Coatings," by Erick Larson, of Stevenson, Greist and Larson, Consulting Engineers, with a chapter on cathodic protection by Geo. I. Rhodes, vice-president, Ford, Bacon & Davis, Inc., Engineers. 1st ed. 1938. 455 + xi pp., 5¾ x 8½ in., clothbound. Published by American Gas Journal, Inc., 53 Park Place, New York, N. Y. Price, $2.50]

The object of the author has been to collect, coördinate and explain in readily understandable terms the various theories of corrosion and of pipe protection as developed by research.

Among the subjects covered are corrosion theories, electrochemical theory, stray current electrolysis, soil surveys, electrical characteristics of soils, soil testing with resistance rods, soil analysis, laboratory test for soil corrosivity, burial tests, survey by observation, corrosion survey, collection and use of corrosion measurements, summary of soil survey procedure, necessary qualities of a protective coating, pipe surface preparation, paints, petrolatum coatings, vitreous enamel and synthetic resin coatings, primers, asphalt coatings, tar base enamel coatings, pipe coating fillers, pipe coating shields, cement coatings, tests, and cathodic protection.

Sam, you better SCRAM!

WHEN the last gurgle of water makes its exit from the water glass, about the only thing left to do is kill the fire and run for cover. But if Sam is like most people who tend boilers, he'll probably scramble to the feed valve and send a big stream of cold water into an over-heated boiler. You know the rest of THAT story.

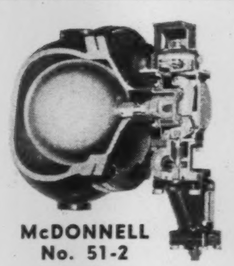
The simple point is that no one under the sun knows when a steam boiler may lose its water—or what may happen to it when it does. No gauge glass is watched closely enough to safeguard the boiler from low water. In fact, in these days of automatic heat they are watched less than they ever were. This, along with higher rates of firing, has made the low water hazard greater than ever before.

But the pleasant side of the picture is that McDonnell Boiler Water Level Controls are more dependable than they ever were before—and that is *something* in dependability.

This very minute, with the heating season right around the corner, ask yourself whether it is good business to permit any boiler—hand, oil, stoker, or gas fired—to go through another season without McDonnell Boiler Water Level Control.

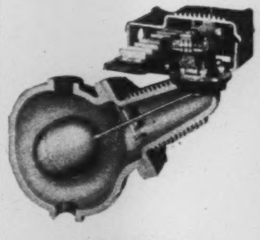
There is a type for every size of boiler operating at any pressure up to 150 lbs. Two typical units are briefly described opposite Write for complete description, prices, service recommendations, and installation data.

McDONNELL & MILLER
1316 Wrigley Bldg., Chicago, Illinois
"Doing One Thing Well"



McDONNELL No. 51-2
—for large, low pressure boilers

A feeder and cut-off combined — for automatically fired steam boilers above 5,000 sq. ft. capacity; operating at pressures up to 35 lbs. The feeder takes care of all normal operation, and the low water cut-off switch stops the burner if an emergency should arise such as extreme priming and foaming. For smaller boilers use the No. 47-2. Other types for higher pressures. All are made without the low water cut-off switch for use on hand-fired boilers.



McDONNELL No. 150
—for high pressure boilers

Here is the answer to water level control for the high pressure boiler. It may be used as a low water cut-off — a cut-off and low water alarm — or combined cut-off and feed-pump control. Ask for typical hook ups.

McDONNELL
BOILER FEEDERS AND LOW WATER CUT-OFFS

HOWELL Makes Sure of 2 Things:
1. Unsurpassed Performance
2. Quiet Operation

Complete Line Motors for Every Air Conditioning Application

½ to 150 H. P.

Vibration in an electric motor spells excessive wear . . . then comes trouble! By means of the **close-limit** VIBRATION TEST—given every HOWELL Motor—we make **sure** that rotor assembly and bearings are in **perfect** balance.

This precision test is one of the most important safeguards taken at HOWELL to insure year after year of **unsurpassed** operation.

But motors for air conditioning drives must be more than dependable. They must be QUIET. And so we make **sure** on this score, too!

The HOWELL QUIETNESS TEST—as **exacting** as any in the industry—is conducted in a sound-proof laboratory with motor running at **full** load speed. Results are read in decibels. **Quiet performance** is an outstanding feature of every HOWELL Motor.

HOWELL MOTORS Make Good on Hard Jobs

Motor Specialists! *When you buy HOWELL, you deal with one of our experienced motor application engineers. This local representative will have many suggestions on how to obtain greater satisfaction and greater economy* ***through better engineering.*** *One job will fully demonstrate what we mean! May we have your next motor inquiry?*

HOWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN
Representatives In All Principal Cities

Schools and Study Courses

University of Wisconsin Offers Home Study in Air Conditioning

The University of Wisconsin extension division, Madison, Wis., has announced three home study courses in technical fields: elements of air conditioning, heating and ventilation, and refrigeration. Each is independent of the others.

The course in air conditioning (16 assignments) explains the scientific principles involved and their practical application to the conditioning of the air in homes, factories, offices, and other buildings. The instruction in heating and ventilation (24 assignments) covers the planning, estimating, installing and operating of heating and ventilating systems. The course in refrigeration (24 assignments) teaches the principles involved in the construction and operation of refrigeration systems and trains the student in their practical application.

Conventions and Expositions

Air Conditioning Short Course: August 17-19, Agricultural and Mechanical College of Texas, College Station, Tex., under auspices of department of mechanical engineering.

National Industrial Advertisers Association: 1939 national conference, September 20-22, Hotel New Yorker, New York, N. Y. General chairman, Edward A. Phoenix, Johns-Manville Corp., New York, N. Y.

Exposition of Building, Industry and Services: October 4-6, Hotel Statler, Detroit, Mich. (concurrently with annual convention of Mortgage Bankers Association of America). Secretary-Treasurer, George H. Patterson, 111 W. Washington St., Chicago, Ill.

Joint meeting, Fuels Division, American Society of Mechanical Engineers, and Coal Division, American Institute of Mining and Metallurgical Engineers: October 5-7, Deshler-Wallick Hotel, Columbus, Ohio. Chairman, R. A. Sherman, Battelle Memorial Institute, Columbus, Ohio. Papers to be given on coördination of fuel engineering, a proposed code for testing coal, and recent developments in equipment for burning anthracite coal.

American Gas Association: Annual convention, October 9-12, Hotel Pennsylvania, New York, N. Y. Headquarters Office, 420 Lexington Ave., New York, N. Y.

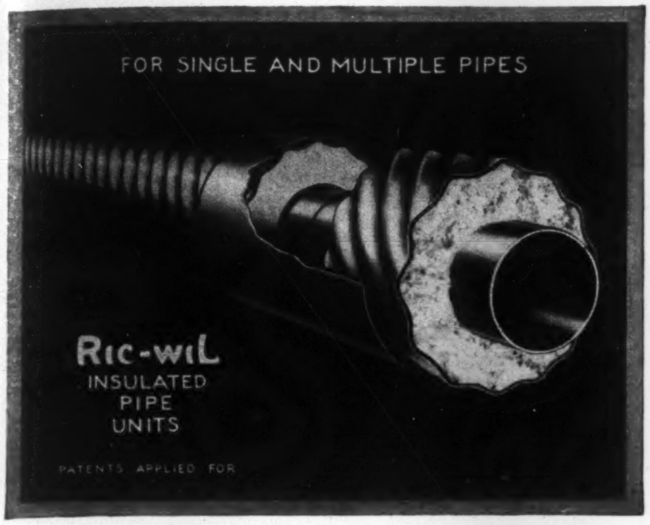
American Public Health Association: Annual meeting, October 17-20, Hotel William Penn, Pittsburgh, Pa. Headquarters office, 50 W. 50th St., New York, N. Y.

American Welding Society: Annual meeting, week of October 22, Stevens Hotel, Chicago, Ill. Headquarters office, 33 W. 39th St., New York, N. Y. Papers to be presented include Oxy-acetylene Welding of Red Brass Pipe, by A. N. Kugler; 90 Deg Welded Nozzles, Piping Calculations, Design and Fabrication, by F. C. Fantz and W. G. Hooper; Extensions of Fusion Welding in Special Pipe and Pipe Fitting Applications, by E. Hall Taylor; and Welding in the Manufacture of Valves for High Pressures and Temperatures, by W. F. Crawford.

National Metals Exposition: Week of October 22, International Amphitheater, Chicago, Ill.

Symposium on Measurement and Control of Temperature: November 2-4, New York, N. Y. Temperature Symposium Committee, American Institute of Physics, 175 Fifth Ave., New York, N. Y.

American Society of Mechanical Engineers: Annual meeting, December 4-8, Philadelphia, Pa. Headquarters office, 29 W. 39th St., New York, N. Y.



U. S. Patents 1,991,455 and 2,050,968. Canadian Patent 360,816.
Other Patents Pending.

RIC-WIL Insulated PIPE UNITS

RIC-WIL PRE-SEALED UNITS for underground steam lines, in 20-foot lengths, come on the job completely assembled, ready for installation.

ARMCO HEL-COR CONDUIT is heavy gauge pure ingot iron, and on standard units is galvanized and coated outside with thick layer of asphalt.

WATERPROOF Hel-Cor lock seam, rolled in during manufacturing process, gives positive water-tight joint.

STRENGTH ample to meet every condition, impacts, etc., even in very shallow trenches—yet conduit is extremely light in weight.

DURABILITY—Armco experience indicates a life expectancy of 40 years in this type of conduit.

INSULATION for standard units is sectional 85% asbestos with heavy asphalt-felt jacket, with laps cemented (or any other insulation as specified).

PIPE SUPPORT GUIDES are semi-steel of sliding type, removable, and seal ends of units. Positive support and alignment. Pipes easily rotated for welding.

STEAM PIPE may be of any material, in 20-foot lengths or any lengths desired. Expansion of both pipe and units provided for in construction according to approved engineering practice.

CONNECTOR SLEEVES of heavy gauge Armco asbestos bonded ingot iron, easily slipped in place, and hermetically sealed with high melting point non-porous mastic cement furnished.

FITTINGS—elbows, T-branches, etc., also oversize conduit for expansion bends, furnished as needed.

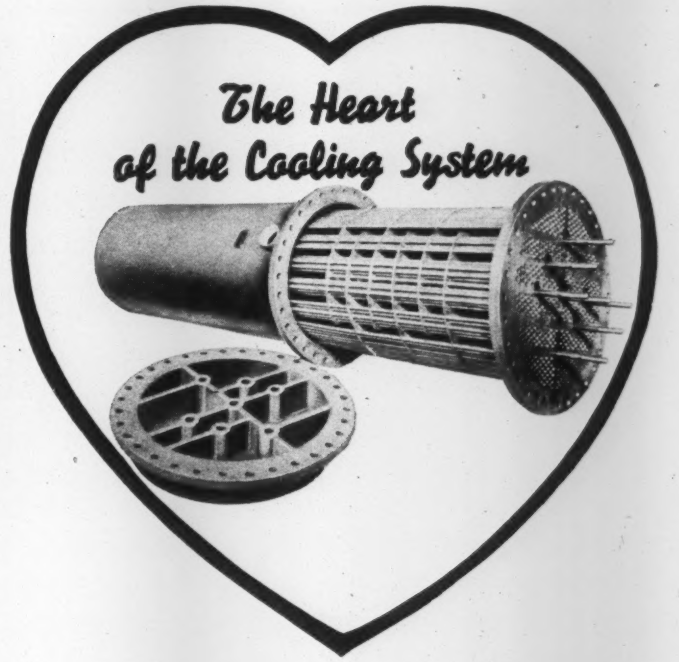
Descriptive bulletin sent on request.

The Ric-wiL Co., Union Commerce Bldg., Cleveland, O.
New York San Francisco Chicago
Agents in principal cities

REGISTERED IN U. S. PATENT OFFICE

·RIC-WIL·

CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES



The success of the entire cooling system depends on the reliability of the water cooler.

Patterson Freon Water Coolers have never failed to chill an ample volume of water to do the necessary cooling.

Expert engineering and design, careful manufacture and testing by expert mechanics assure every Patterson Cooler of delivering its rated capacity continuously.

Beware of heart-trouble—specify and buy Patterson Freon Water Coolers.

Write for catalog today.

The Patterson-Kelley Co., Inc.
107 Warren St. East Stroudsburg, Pa.

Patterson Freon Water Coolers

Safest Choice

for Key Drives
in
Air Conditioning
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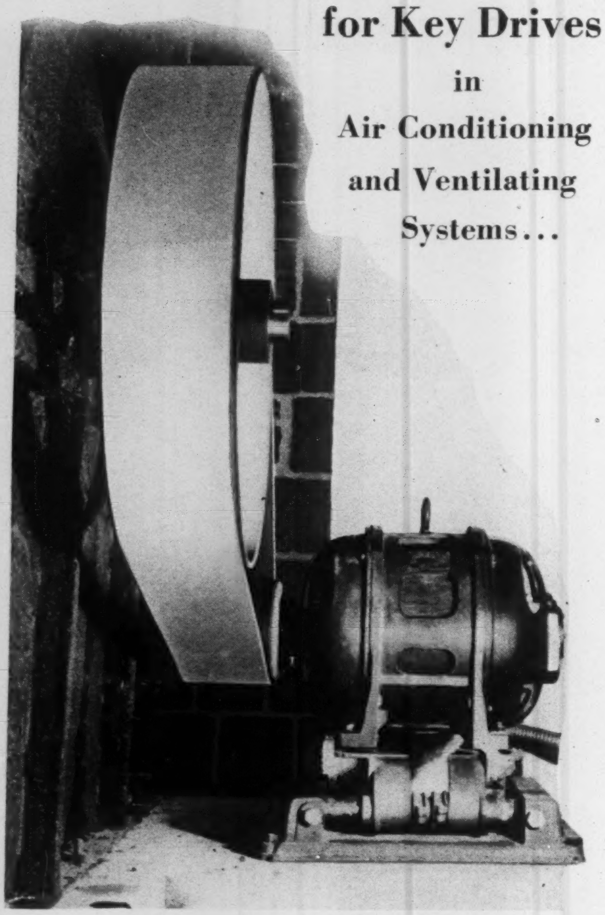
Systems...



RHOADS TANNATE
LEATHER BELTING

TANNATE grip keeps power flowing smoothly, steadily, economically . . . TANNATE toughness makes the same belts "deliver" over periods of years, keeps air pressure up to standard, cuts belt replacement and installation costs! TANNATE dependability makes trouble-free installations!

● Shown in illustration: TANNATE Belt on fan drive in air-conditioning system of large department store. Fan supplies air to 3 auxiliary fans which supply and return air from 3 floors. On the job more than two years—TANNATE has given perfect performance! And that is a typical TANNATE record!

Ask for Engineering Data . . . No obligation.

J. E. RHOADS & SONS
Established 1702
35 North Sixth Street, Philadelphia, Pa.
New York Chicago Atlanta Cleveland
Factory and Tannery—Wilmington, Del.

Refrigeration Service Engineers Society: Annual convention, January 15-18, Chicago, Ill. Secretary, H. T. McDermott, 433 N. Waller Ave., Chicago, Ill.

Refrigeration and Air Conditioning Exhibition: January 15-18, Stevens Hotel, Chicago, Ill. Exhibition manager, R. M. McClure, 111 W. Washington St., Chicago, Ill.

American Society of Refrigerating Engineers: Annual meeting, January 16-19, Blackstone Hotel, Chicago, Ill. Secretary, D. L. Fiske, 37 W. 39th St., New York, N. Y.

American Society of Heating and Ventilating Engineers: Annual meeting, January 22-26, 1940, Hotel Statler, Cleveland, Ohio. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Sixth International Heating and Ventilating Exposition: January 22-26, 1940, Cleveland Public Hall, Cleveland, Ohio. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

National Warm Air Heating and Air Conditioning Association: Annual convention, January 22-24, Hotel Hollenden, Cleveland, Ohio. Managing Director, Allen W. Williams, 5 E. Long St., Columbus, Ohio.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 110. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 3223. AIR CLEANING: American Air Filter Co., Inc., 107 Central Ave., Louisville, Ky. 8 p. bulletin (250) on the "Electro-Matic" air filter which combines electrical precipitation with automatic air filtering, describing and illustrating construction.

No. 3224. AIR CONDITIONING: Carrier Corp., 302 S. Geddes St., Syracuse, N. Y. 12 p. condensed catalog on air conditioning, refrigeration and heating equipment for industrial applications, with quick reference data on application, operation, installation, dimensions, capacities, etc.

No. 3225. AIR CONDITIONING AND REFRIGERATION SUPPLIES: Republic Electric Co., 114-118 E. First St., Davenport, Ia. 157 p. catalog of supplies and equipment for refrigeration, air conditioning and automatic heating.

No. 3226. AIR DIFFUSERS: Tuttle & Bailey, Inc., Corbin Ave., New Britain, Conn. 8 p. bulletin describing the "Aerofuse" outlet, a flush type ceiling diffuser, showing photographs of smoke tests, describing design features, and giving engineering data, sizes and list prices.

No. 3227. AIR ELIMINATORS: Gorton Heating Corp., Cranford, N. J. 4 p. bulletin (108) on high pressure air eliminators and automatic bypass for venting steam coils, steam mains, unit heaters, and process equipment.

No. 3228. AIR VALVES: Herske & Timmis, Inc., 33 W. 60th St., New York, N. Y. 2 p. data sheet on air valves and quick vents for radiators.

No. 3229. ALLOYS: Colonial Alloys Co., E. Somerset, Trenton Ave., and Reading R. R., Philadelphia, Pa. Bulletins on use of "Colalloy" lightweight metal in chemical and textile industries.

No. 3230. BLOWER UNITS: L. J. Wing Mfg. Co., 14th St. and 7th Ave., New York, N. Y. 4 p. bulletin (CO-3) on motorized blower units for application to high pressure boilers to produce high static pressures at low speeds. Features of design and applications are described and illustrated.

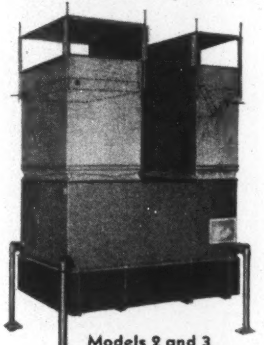
No. 3231. BRAKES AND FOLDERS: Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. 18 p.

BEAUTIFULLY MODERN
. . . Inside and Out
Conditioned by UTICA

Residence for Garrett A. Hobart, Jr., at Tuxedo Park, N.Y.
Architect, William Lescaze Consulting Engineer, Leslie Hart

THERE'S a particular pleasure in home ownership when a house is planned as completely as this residence at Tuxedo Park, N.Y. True washed air conditioning installed by MacHenry Grant Corp. of New York City, brings summer comfort with cooling, and healthful winter heating and humidification.

In this modern home, the air is washed by a coarse rain spray and scrubbed against the sides of the spiral aqualute chamber in the Utica Hydro-Air Conditioner. It comes to the rooms free from impurities —dust and pollen so common in the air are removed in this cleansing bath. This brings healthful, purified air to every corner of the house —and clean air protects furnishings and makes house work easier.



Models 2 and 3 Utica Air Conditioner with Headers

Conditioned for Year 'Round Comfort

Cool, dehumidified air, properly controlled for comfort, banishes heat and humidity in summer.

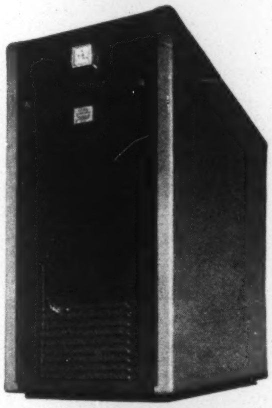
A fin-type heating coil provides heat for the main living quarters and the balance of the house is heated by radiation. Washed, humidified, heated, gently circulated air brings a new conception of home comfort in the winter. Automatic zone control gives an equalized distribution of heat to every room—there are no cold spots and drafts to mar the pleasure of living in this charming home.

Get the Story on Air Conditioning

Heating Contractors are discovering that the air conditioning field offers a source of added income where jobs of this type are being installed. Progressive men are turning to air conditioning to supplement the heating systems they are installing when their customers inquire about humidity and air control.

It is good to know the facts on air conditioning so you can give your customers a clear story of its advantages. It will mean more sales for you.

We will be glad to send you the story of Utica Hydro-Air Conditioning.



New Utica OB Series Oil Burning Boiler

UTICA RADIATOR CORPORATION
UTICA, N. Y.
Boilers • Radiators • Convectors • Air Conditioners

THE WORLD'S GREATEST ENGINEERING LABORATORY

IT MAY surprise you to learn that students of the International Correspondence Schools have at their disposal the biggest and best equipped engineering laboratory in the world. And that "lab" is —

The engineering industry itself!

I. C. S. students enroll for courses related to their work. Their place of work is their "lab." There they prove and apply what they learn through I. C. S. proved home-study methods. There they prepare themselves for greater responsibility by combining study with actual practice. It is significant that many outstanding men in the engineering world gladly acknowledge the part that I. C. S. training played in their development as leaders.

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Without cost or obligation, please furnish me with full particulars about the subject *before* which I have marked X:

☐ **Air Conditioning & Cooling**
☐ **Heating & Ventilation**
☐ **Building Estimating**
☐ **Sheet Metal Work**

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☐ Architectural Drafting
☐ Architecture
☐ Auto Elec. Technician
☐ Auto Technician
☐ Aviation Engineering
☐ Boilermaking
☐ Bridge Engineering
☐ Building Estimating
☐ Chemistry
☐ Civil Engineering
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☐ Contracting and Building
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☐ Electrical Engineering
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☐ Fire Bosses
☐ Foremanship
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☐ Steam Elec. Eng'ring
☐ Steam Engineering
☐ Steam Fitting
☐ Structural Drafting
☐ Structural Engineering
☐ Surveying & Mapping
☐ Telegraph Engineering
☐ Telephone Work
☐ Toolmaking
☐ Ventilation
☐ Welding, Electric and Gas
☐ Woolen Manufacturing

BUSINESS SUBJECTS

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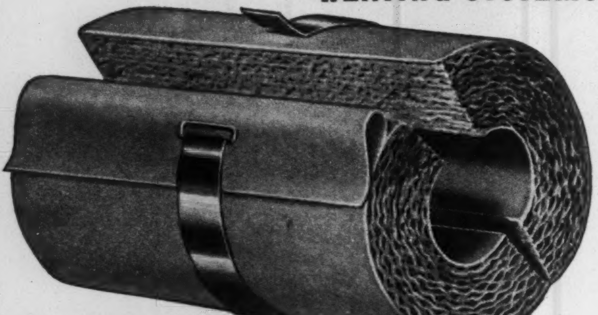
☐ Advertising
☐ Bookkeeping
☐ Business Correspondence
☐ Business Management
☐ Civil Service
☐ College Preparatory
☐ Cost Accounting
☐ C. P. Accounting
☐ First Yr. Col. Subjects
☐ French
☐ High School Subjects
☐ Managing Men at Work
☐ Salesmanship
☐ Spanish
☐ Secretarial Work
☐ Stenog. and Typing
☐ Traffic Management

Name..*Age*..............
Address..
City..................................*State*....................
Present Position..

Canadian residents send coupon to International Correspondence Schools Canadian, Limited, Montreal, Canada. British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England.

Careycel
PIPE COVERING

For Low Pressure Steam and Hot Water
HEATING SYSTEMS



For Temperatures
Up to 300° F

HEAT loss through CAREYCEL is 30% less than through an equal thickness of aircell insulation (according to Mellon Institute tests). Shrinkage is only 1/10th that of aircell. Eliminates heat-wasting cracks at joints—makes a better-looking job—increases efficiency of heating equipment—saves fuel—costs no more than ordinary aircell—assures customer satisfaction, better profits for the heating contractor. Write Dept. 25 for details and specifications.

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Dependable Products Since 1873
BRANCHES IN PRINCIPAL CITIES

You're in the Black

every time you reinstall a DART

Dart service doesn't stop after one installation. For you can take a Dart off the line, reinstall it again and again, and get a tight joint every time.

That's real economy. In fact, it's like getting several unions free for every single Dart you buy.

Darts give you this extra service because they have ground bronze seats, **matched** for tight fits in **repeated use.** And only Darts combine **matched seats** with bodies and nuts of air-refined malleable iron, that resists pipe strains, and wrench abuse—and clean cut threads that save on installation time.

So next time you change piping, change to Darts. And start saving. Want to give one a try at our expense? Write us what size.

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UNIONS
E. M. DART MFG. CO., PROVIDENCE, R. I.
SALES AGENTS THE FAIRBANKS COMPANY NEW YORK AND ALL BRANCHES
CANADIAN FACTORY DART UNION COMPANY LTD TORONTO CANADA

bulletin (74-A) covering manually and power operated folders and brakes as used in the fabrication of air conditioning ducts and other sheet metal construction.

No. 3232. BRAZING ALLOYS: Handy & Harman, 82 Fulton St., New York, N. Y. New price list on "Sil-Fos" and "Easy-Flo" brazing alloys, because of the reduction in the price of silver.

No. 3233. COMBUSTION CONTROL: Wheelco Instruments Co., 1933 S. Halsted St., Chicago, Ill. 1 p. data sheet on "Flame-otrol" combustion safeguard instrument to cut off the fuel supply in the event of flame failure.

No. 3234. COMBUSTION TESTING INSTRUMENTS: F. W. Dwyer Mfg. Co., 565 W. Washington Blvd., Chicago, Ill. 4 p. bulletin on CO_2 indicators and draft gages, describing them and with engineering data on their use.

No. 3235. CONVECTORS: Herske & Timmis, Inc., 33 W. 60th St., New York, N. Y. 4 p. data sheet on convectors constructed of a 1¼ in. circular steel waterway with steel fins fused and bonded together with an aluminum alloy. Rating tables are included for steam, water or vapor.

No. 3236. DEAERATING HEATERS: Worthington Pump & Machinery Corp., Harrison, N. J. 6 p. bulletin (W-210-B24) on deaerating heaters and deaerators of the vertical double element type with cross section views showing interior construction and detailed explanation of features.

No. 3237. DECIMAL EQUIVALENTS: Frederick Post Co., Box 803, Chicago, Ill. Decalcomania table of decimal equivalents sized to fit T-squares and available on request to persons in the architectural, engineering, designing and drafting professions.

No. 3238. DEEP WELL WATER SYSTEMS: Decatur Pump Co., 2750 Nelson Park Rd., Decatur, Ill. 28 p. catalog bulletin (40-60A) on shallow and deep well water systems with description of design features, specification tables, and engineering data.

No. 3239. DESLUDGING VALVES: Permutit Co., 330 W. 42nd St., New York, N. Y. 2 p. bulletin (2218) on automatic desludging valves for hot lime soda softeners to supplement the regular blow-off valve and insure proper blow-off with minimum loss of hot water.

No. 3240. FURNACE REFRACTORIES: McLeod & Henry Co., Inc., Troy, N. Y. 12 p. bulletin on silicon carbide, fire clay, and high alumina furnace refractories with information on characteristics and uses.

No. 3241. HEATING CONTROL: Herske & Timmis, Inc., 33 W. 60th St., New York, N. Y. 4 p. bulletin on automatic heating control for multi-occupancy buildings with any type steam heating system and any oil burner, stoker or gas boiler, describing construction and operation.

No. 3242. HUMIDITY RECORDERS AND CONTROLLERS: Bristol Co., Platts Bridge, Waterbury, Conn. Bulletin (525) on humidity recorders and controllers for air conditioning, heating and drying processes, with information on wet and dry bulb psychrometers and instruments for recording humidity and temperature directly on the same chart.

No. 3243. IMMERSION HEATERS: General Electric Co., 1 River Rd., Schenectady, N. Y. 8 p. bulletin (GEA-3195) on how to heat electroplating baths with immersion heaters, including installation hints, engineering data, instructions on calculations of power requirements, etc.

No. 3244. LOW WATER CUT-OFFS: McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill. 4 p. bulletin on built-in type low water cut-offs, describing and illustrating their advantages and showing some of the many types available.

No. 3245. MILLS: Stephens-Adamson Mfg. Co., 272 Ridgeway Ave., Aurora, Ill. 12 p. catalog (639) on the "Mosley" mill, which is an air swept attrition type for fine grinding and pulverizing dry materials, with information on pulverizing and burning coal in small and medium size industrial boilers.

No. 3246. MOTORS: Allis-Chalmers Mfg. Co., Milwaukee, Wis. 8 p. bulletin and price list (B-6010) on squirrel cage and

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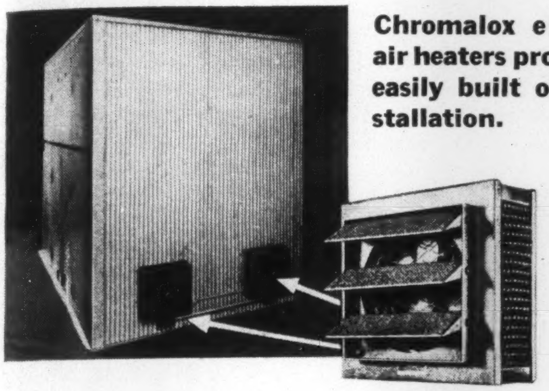
Chromalox electric air heaters provide an easily built oven installation.



The Wiegand staff of electric heat specialists is ready, without obligation, to advise and aid in any heating problem. A pencil sketch and short description secures this cooperation. The 64-page Chromalox catalog sent at your request.

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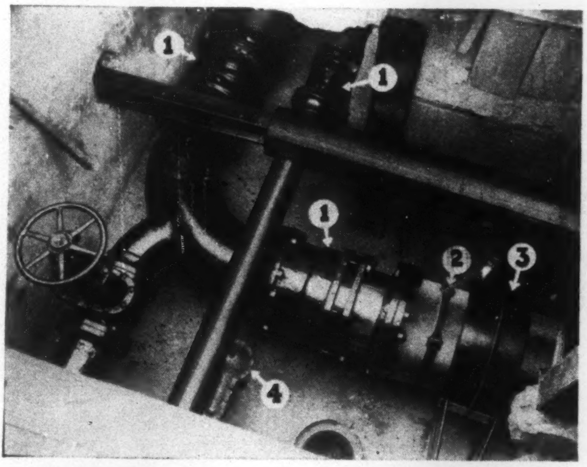

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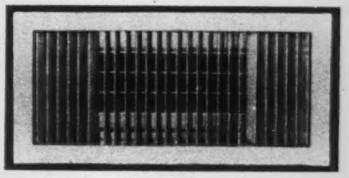

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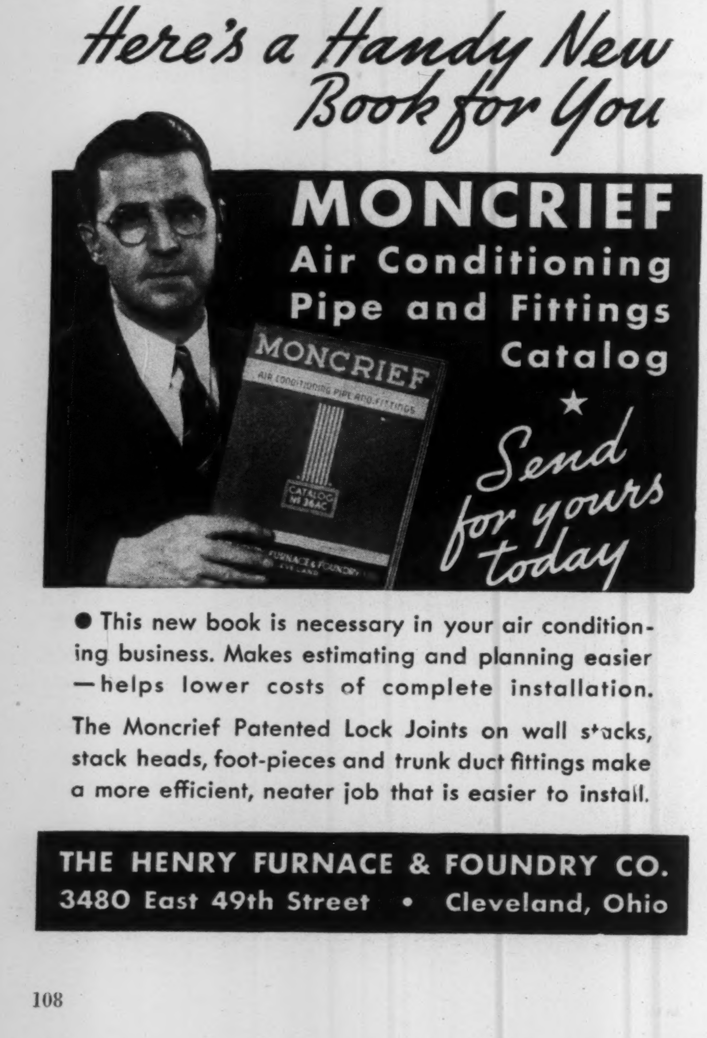

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3480 East 49th Street • Cleveland, Ohio

direct current motors, illustrating and tabulating types and their applications and giving list prices.

No. 3247. MOTORS: General Electric Co., 1 River Rd., Schenectady, N. Y. 4 p. bulletin (GEA-137D) on low speed synchronous motors with ratings from 20 hp at 257 rpm to 225 hp at 450 rpm.

No. 3248. MOTORS: Howell Electric Motors Co., Howell, Mich. 4 p. bulletin (EK) on polyphase and single phase explosion proof motors built in sizes from ½ to 50 hp.

No. 3249. NICKEL ALLOYS: International Nickel Co., Inc., 67 Wall St., New York, N. Y. 6 p. folder of basic information on mechanical, corrosion resistant, and other properties of rolled nickel, Monel and other high nickel alloys.

No. 3250. OIL BURNER MOTORS AND PARTS: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 2 p. leaflet (F-8487) on motors and motor parts for industrial oil burners, including complete line of single phase and polyphase types.

No. 3251. OIL IN REFRIGERANTS: Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y. Issue of "Fedders News" dated June, 1939, including an article on effect of oil in refrigerant upon valve capacity. Also issue dated May, 1939, with information on oil in "Freon" and its effect upon coil capacity.

No. 3252. pH INSTRUMENTS: Bristol Co., Platts Bridge, Waterbury, Conn. New bulletin (536) of information on pH recording and controlling instruments which are designed to place hydrogen-ion concentration "under the same close control as that of other process variables."

No. 3253. PILLOW BLOCKS: Ahlberg Bearing Co., 3025 W. 47th St., Chicago, Ill. 4 p. bulletin announcing two new series of pillow blocks, one of which is a sound insulated type for light duty air conditioning and ventilating equipment.

No. 3254. PIPE MACHINES: Oster Mfg. Co., 2057 E. 61st Pl., Cleveland, Ohio. 32 p. catalog (39-A) describing the hand tool and portable pipe machine portion of the manufacturer's line. A new portable pipe machine, a new bolt machine and a new power vise stand are included.

No. 3255. PRESSURE FILTERS: Permutit Co., 330 W. 42nd St., New York, N. Y. 16 p. catalog (2225) on pressure water filters incorporating the manufacturer's deflector plate distributor.

No. 3256. PROCESS CONTROL: Bristol Co., Platts Bridge, Waterbury, Conn. Bulletin (512) on the manufacturer's system of coördinated process control, calling attention to industrial plant executives certain facts regarding modern process control technique and the possibilities of such control.

No. 3257. PUMPS: Decatur Pump Co., 2750 Nelson Park Rd., Decatur, Ill. 12 p. bulletin (115-A) on turbine and centrifugal pumps for semi-industrial applications with data on construction features, capacity, horsepower tables, etc.

No. 3258. PUMPS: Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa. 32 p. bulletin (5-H) on multistage steam jet vacuum pumps describing and illustrating the various types and their applications, together with information on steam jet boosters, vacuum refrigerating apparatus, operation of steam jet vacuum pumps and testing equipment.

No. 3259. RADIATOR VALVES: Herske & Timmis, Inc., 33 W. 60th St., New York, N. Y. 8 p. bulletin on "Micro-Orifice" valves for balancing steam distribution in two pipe vapor or vacuum heating systems with orifices externally adjustable to calibrated setting of any size radiator up to 150 sq ft. Also, a two page leaflet on packless and packed steam valves, and hot water valves and elbows.

No. 3260. RESISTANCE THERMOMETERS: Bristol Co., Platts Bridge, Waterbury, Conn. Bulletin (529) on strip chart resistance thermometers for temperatures between minus 40 F and plus 300 F. As many as eight temperature records may be made simultaneously on one chart.

No. 3261. SHEET METAL MACHINERY: Ward Machinery Co., 564 W. Washington Blvd., Chicago, Ill. 64 p. catalog (39) on machines, tools and supplies for fabricating sheet metal, with complete descriptions and illustrations.

CLINTON Perforated METAL GRILLES

WISSCO GRILLES are made in various gauges of steel, brass, Wissco Bronze, monel and stainless steel and are available regularly up to 60 x 156 inches in all finishes.

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The Conduit for Underground Steam Lines

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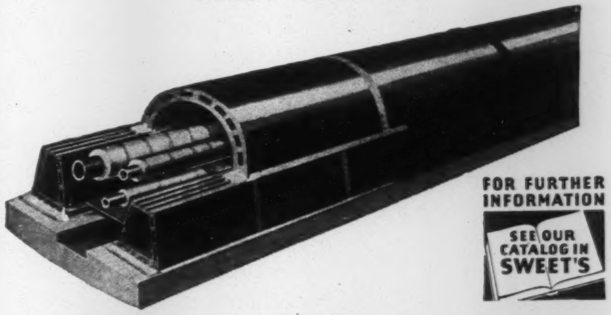

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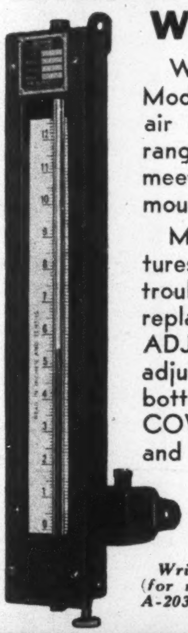
MERIAM MANOMETERS

Model A-275 Direct Reading Well Type Manometer



With the introduction of our new Model A-275, we now offer heating and air conditioning engineers a complete range of Well Type Manometers to meet every requirement regarding size, mounting style, and operating pressure.

Model A-275 has these important features: GLAND PACKING, insuring trouble-free, leak-proof service and tube replacement in the field; ZERO SCALE ADJUSTMENT, permitting quick, easy adjustment by outside knurl screw at the bottom; IMPROVED FLUSH FRONT COVER, making the gauge dustproof and facilitating panel mounting.

Plain cover for surface or wall mounting is standard; flush front cover available.

Write for Bulletin B fully describing Model A-275 (for moderate operating pressures) and Model A-203 (for higher operating pressures.)

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Instruments for Indicating Pressure or Flow of Liquids and Gases
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from mine to consumer
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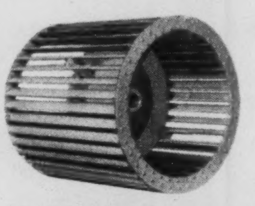
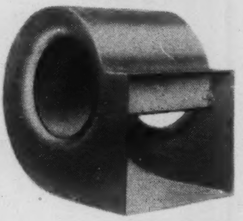
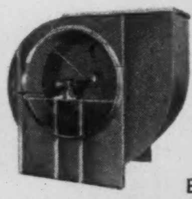

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LOW HORSEPOWER
QUIET OPERATING
SINGLE and DOUBLE INLET
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UNIT AIR CONDITIONERS
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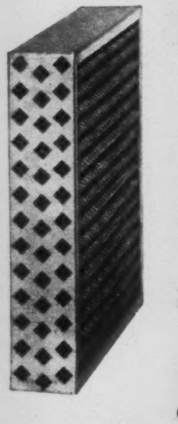

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For greater efficiency, longer life and increased economy specify AIR-MAZE permanent, cleanable air filter panels. Patented all-metal filter element, embodying novel baffle-impingement principle, intercepts even the finest dust, yet permits free flow of air. Needs no replacement. Easily cleaned and charged. Write for Installation Planning Catalog PPS-38.

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CLEANABLE AIR FILTER PANELS

AN IMPROVED TONG *for* DOUBLE DUTY

Reversible Jaws that handle either pipe or fittings without changing or adjusting parts. 7 sizes for pipe & fittings, 1/8 to 12".

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SUPERIOR DROP FORGED TOOLS
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PIPE AND FITTINGS TONGS

Heating, Piping and Air Conditioning,
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Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1681	1682	1683	1684	1685	1686	1687
1688	1689	1690	1691			
3223	3224	3225	3226	3227	3228	3229
3230	3231	3232	3233	3234	3235	3236
3237	3238	3239	3240	3241	3242	3243
3244	3245	3246	3247	3248	3249	3250
3251	3252	3253	3254	3255	3256	3257
3258	3259	3260	3261	3262	3263	3264
3265	3266	3267	3268	3269	3270	

Name .... Title ....
Company ....
Address ....
City .... State...........

No. 3262. SPRAY WHEELS: D. J. Murray Mfg. Co., Wausau, Wis. 8 p. bulletin on new spray wheel originally intended for air washer service but with many applications in the chemical processing industries, such as cracking gasoline, removing dust atoms from the air, etc. Data on use of the wheels in air washers and other application information are included.

No. 3263. TRAPS: Herske & Timmis, Inc., 33 W. 60th St., New York, N. Y. 4 p. bulletin on thermostatic, float and thermostatic, high pressure and boiler return traps, and air eliminators and strainers, with data on dimensions and ratings.

No. 3264. VALVES: Automatic Switch Co., 41 E. 11th St., New York, N. Y. Series of new bulletins on "Asco" valves, including three way diaphragm operated solenoid pilot control valves; four way piston type diaphragm operated and solenoid control valves; valves for hydraulic cylinder control; and other types.

No. 3265. VALVES: Jenkins Bros., 80 White St., New York, N. Y. 24 p. booklet presenting "The Inside Story" of the manufacturer's 125 lb iron valves, including regrinding globe valves, regrinding swing checks, and O S & Y gate valves. A handy reference chart of types and sizes is presented.

No. 3266. V-BELT DATA: Manhattan Rubber Mfg., Div. of Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J. 60 p. engineering data book on "Condor" v-belts, in two parts, the first covering standard drives and eliminating the necessity of working out calculations, and the second part including sheave factors for designing new or special drives. Belt comparison tables and other general data are included.

No. 3267. WATER COOLERS: Frick Co., Waynesboro, Pa. 8 p. bulletin (153-F) on "Instant" water coolers for cooling water or other liquids through a wide temperature range quickly. Information is given on the operating principle, applications and details of construction.

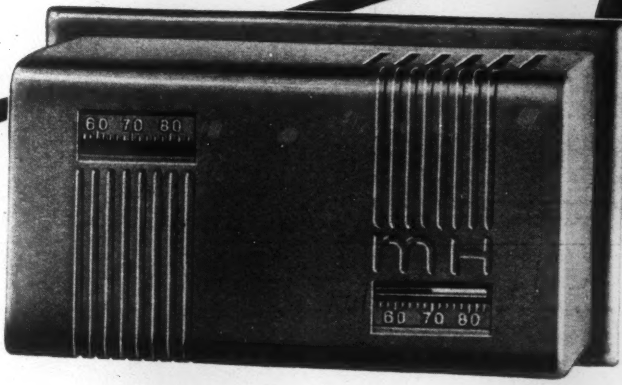
No. 3268. WATER PIPE SIZES: Bridgeport Brass Co., E. Main St., Bridgeport, Conn. 52 p. booklet of technical information on water pipe sizes for plumbing fixtures, branches, risers and mains, compiled by Walter S. Timmis. This is a revised 1939 edition.

No. 3269. WELDING ELECTRODES: McKay Co., McKay Bldg., 1005 Liberty Ave., Pittsburgh, Pa. 16 p. booklet on "Certified" stainless electrodes, representing a complete line to cover all chemical analyses. Each package contains a certification of weld deposit analysis.

No. 3270. WELDING FITTINGS: Taylor Forge & Pipe Works, P. O. Box 485, Chicago, Ill. 4 p. bulletin (392) on new "Centring Weldell" welding fitting which has an integrally forged ring to center the elbow in the pipe, eliminate the need for a packing ring, and provide a guide for weld penetration.

ACCURATE *Performance*

HELMET SEAL *Protection*



Helmet Seal Construction
Adjustable Throttling Range
Greater Sensitivity
Increased Capacity
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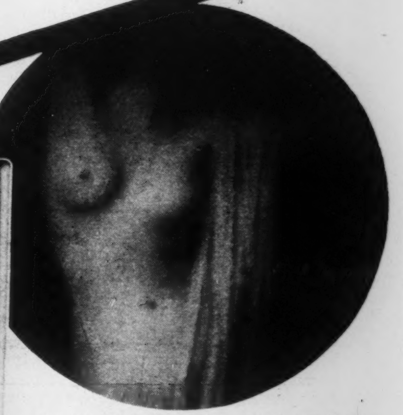


SCULPTURED BEAUTY
Styled by Henry Dreyfus, the Gradustat is as modern in its performance as is its design. It inaugurates a new degree of accuracy and responsiveness in pneumatic control.

THE NEW Minneapolis-Honeywell Gradustat is the only pneumatic thermostat with the famous and exclusive Helmet Seal Construction. Helmet Seal effectively protects all working parts against tampering, foreign matter or corrosion and insures long, trouble-free service. The Gradustat brings a new degree of accuracy and responsiveness, and permits much closer control of large space heating. It uses air only when changing position of valves or dampers, reducing the size of the compressor required by approximately 80%, and increases capacity so that each Gradustat can control a far greater number of units than the ordinary pneumatic thermostat. The Gradustat is but one of the many Minneapolis-Honeywell contributions to the pneumatic control field. Minneapolis-Honeywell Regulator Company, 2701 Fourth Avenue South, Minneapolis, Minn.

MINNEAPOLIS-HONEYWELL

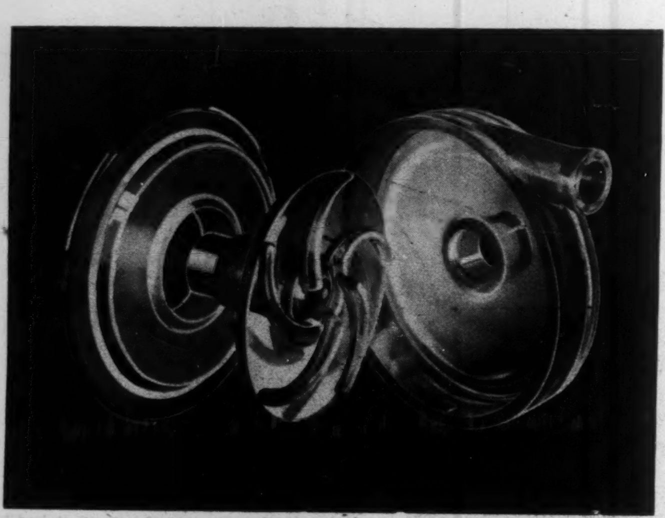
Gradutrol System
.... OF PNEUMATIC CONTROL

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 128. Add the new products and companies listed here to your Directory Section which you received in your January, 1939, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Centrifugal Pump Made of Glass

No. 1692—A new centrifugal pump has been announced which, according to the manufacturer, combines the mechanical advantages of metal with the chemical advantages of glass. It is for use where it is necessary to handle chemical or food products or where the product handled must remain chemically unchanged, as well as for pumping corrosive acids or acid materials in commercial quantity.



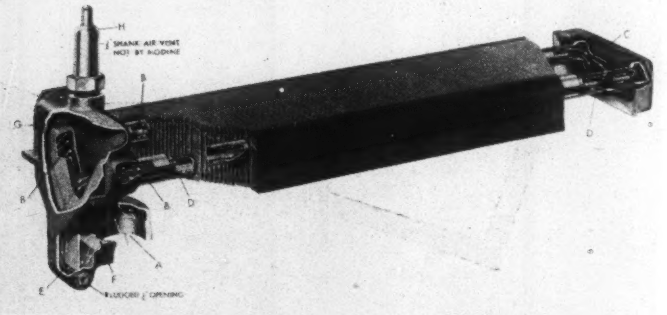
Made of "Pyrex" brand heat and shock resistant glass, the pump impeller and casing are not affected by temperatures up to 150 F in standard design, and 200 F in special design, the maker states. Fully transparent, the interior of the pump and the material being handled are subject to examination at all times for cleanliness, color, sedimentation, etc. The unit may be disassembled and reassembled for cleaning.

Provisions are incorporated to relieve pressure automatically if for any reason it should develop in the interior of the pump before building up to a point where there would be danger of fracture of the glass casing itself.—Nash Engineering Co., South Norwalk, Conn.

One Pipe Steam Convector

No. 1693—A new convector radiator known as the "Quiet-Seal" has been designed for one pipe steam applications.

It operates on a "one way flow" principle to allow steam,



OVER 1000 FAIRBANKS VALVES IN THE ST. LOUIS ARENA ICE RINK

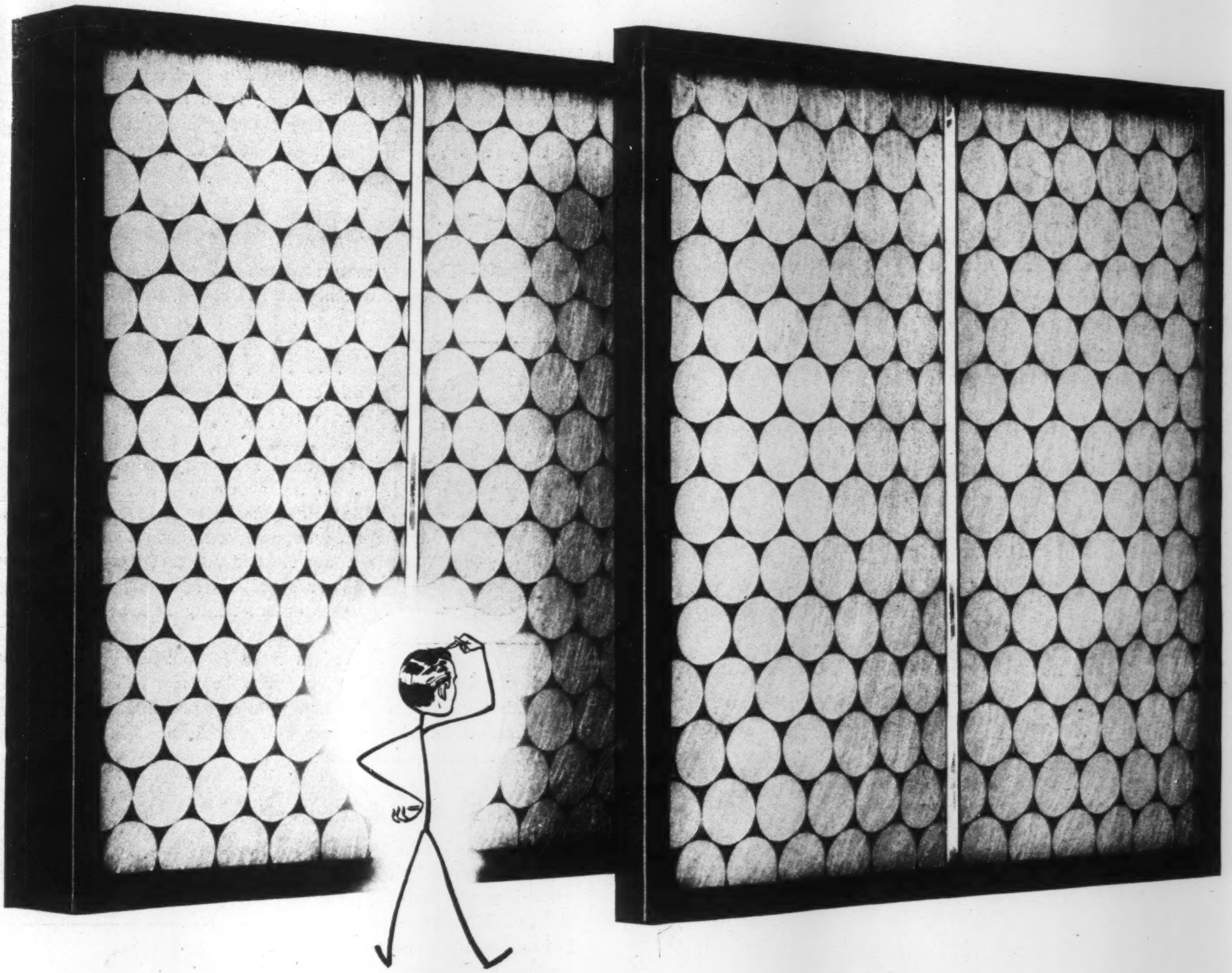
Illustration shows a few of the Fairbanks U-Bolt Gate Valves used to control the refrigerating system in this ice rink.

For installations like this, where it is important to have husky valves that can "take it" . . . and that can be quickly and easily taken apart if they need cleaning . . . Fairbanks U-Bolt Gate Valves materially reduce maintenance costs.

The many super features of these valves are explained in our Bulletin 103. Write for a copy.

The Fairbanks Company
396 Lafayette St. New York, N. Y.
Boston, Pittsburgh—Distributors in Principal Cities
Factories: Binghamton, N. Y. Rome, Ga.

Fairbanks U-BOLT GATE VALVES



Which one of these filters is cheaper for you to use?

THE CORRECT ANSWER IS: the filter on the right—our new 1-inch No. 1 Dust-Stop!

And unless you are using it, you may be wasting as much as $3 out of every $10 you now spend on filter replacements.

Yes, you may be wasting this much even if you are now using our 2-inch Dust-Stop filter (left)—considered by maintenance men to be the most efficient replaceable air filter on the market.

It's like this:

The 2-inch Dust-Stop has always collected the bulk of its dust in the first inch of the filter. But, once this first inch became dirty, you had to throw away *the whole filter*. The new 1-inch No. 1 filter ends this waste. With it, the front half of every 2-inch section becomes a filter by itself. When it gets dirty, you replace only this front inch. The back inch stays in. Since the price of this new 1-inch job is 30% less than the 2-inch Dust-Stop, you pocket $3 out of every $10 you spent before.

When used together, two No. 1 Dust-Stops have the same operating efficiency as the 2-inch filter (now known as the No. 2 Dust-Stop). Their resistance at 300-foot velocity is almost exactly the same—.095″ to .01″ water gauge.

You should use these No. 1 Dust-Stop filters on all installations where dust concentration demands that filters be replaced at frequent intervals.

No. 1 Dust-Stops fit into the same "L" and "V" frame assemblies that you now use for the 2-inch filters. They are made with Fiberglas in two layers, coarse and fine, in order to collect a maximum of dust and dirt.

Get these new No. 1 Dust-Stop filters from any air-conditioning manufacturer, dealer, or jobber of this equipment, or from any listed Dust-Stop distributor, or write us direct.

Copr. 1939—Owens-Corning Fiberglas Corp.

See Fiberglas at the Fairs — New York and San Francisco

FIBERGLAS
DUSTOP
T. M. REG. U. S. PAT. OFFICE
AIR FILTERS
Made by Owens-Corning Fiberglas Corporation, Toledo, Ohio

Miles Laboratories . . Elkhart, Indiana

Hundreds of Motors Used in this New Alka-Seltzer Plant

—Every one a HOWELL

n Both Production and Air Conditioning Drives

½ to 150 H. P.

HOWELL **performance** builds customer acceptance for **more** HOWELL Motors **everytime!** . . . Miles Laboratories, Inc., Elkhart, Indiana—makers of famous Alka-Seltzer—a typical example.

In this company's new glass block plant, HOWELL Motors are used throughout — **over 400 of them now in operation.** They drive the six air conditioning systems, and all machines required in manufacturing.

Says F. A. Lobley, Chief Engineer: "Our decision to **standardize** on HOWELL was based on over 15 years' experience with these trouble-free motors in our former plant. They have **made good** on every drive job we have given them."

For greater customer satisfaction —**as a safeguard against any drive trouble whatsoever** — use HOWELL Motors. We build types for every air conditioning service, and welcome the opportunity to furnish you any desired information. Write us today!

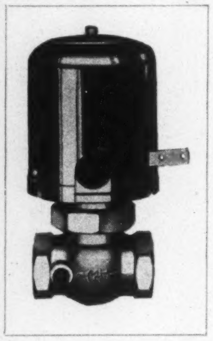
HOWELL RED BAND MOTORS Make Good on Hard Jobs

OWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN
Representatives In All Principal Cities

condensate and air all to flow in the same direction and thus assure full capacity, the maker states. It takes its name from the built in trap or water seal which is designed to eliminate water hammer noises and squirting from air vents. According to the manufacturer, its heating capacity is equal to that of the ordinary two pipe convector of the same size.—Modine Mfg. Co., 17th St., Racine, Wis.

Motorized Gas Valve

No. 1694—The new motorized gas valve illustrated is equipped with a locking screw which, when removed, prevents the occurrence of a hazardous condition if the secondary air damper arm should bind and fail to close, the maker points out. In this event, a latch mechanism allows the gas valve to close under the command of the thermostat but will not allow it to open until the faulty damper is repaired. With the screw in place, the valve may be opened manually so that the gas burner may be operated during an interruption in the electric power supply. When the power supply is resumed, control of the valve automatically returns to the room thermostat.

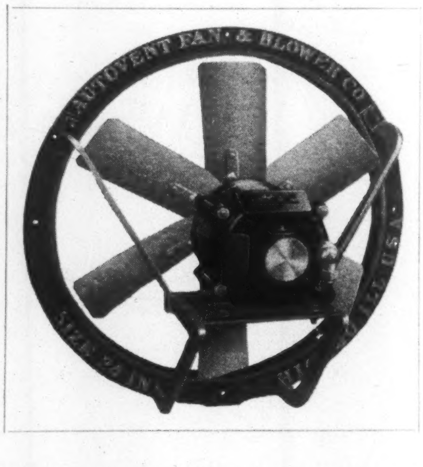


Sizes from ¾ to 2½ in. are available and low voltage control wiring may be used. The valve is for use with a-c current only and with gas pressures not exceeding 4 ounces.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn.

Special Fans with Protective Coatings

No. 1695—A new treatment on acid-moisture proof and vapor-explosion proof propeller fans protects them further against corrosion and explosion. The chemical coating is known as "Heresite" and is recommended by the manufacturer for use on fan wheels where extremely corrosive or highly concentrated acid or gas fume conditions prevail.

Where acid-moisture proof fans are required the coated fan wheels are of heavy gage steel powered by fully enclosed round body motors. In installations where acid and fume conditions are less severe, the wheels are treated with three coats of bakelite lacquer. The vapor-explosion proof units have fan wheels of copper, brass, or other non-ferrous metals and motors bearing the Underwriters Label for Class 1, Group D rating.—Autovent Fan & Blower Co., 1811-27 N. Kostner Ave., Chicago, Ill.



Control Pilot and Diaphragm Valve

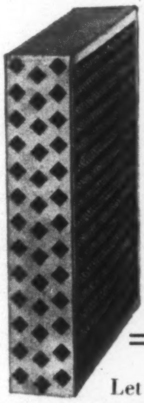
No. 1696—A new all purpose control pilot using either air or water pressure has recently been introduced, together with a new diaphragm valve. The pilot is made in two types, the reverse acting in which a decrease in controlled pressure increases auxiliary pressure, and the direct acting where a de-

NO AIR FILTER
REPLACEMENTS
NEEDED

• Here's a sign you could place on your air conditioning installation if you use AIR-MAZE air filters. AIR-MAZE panels are scientifically designed and built to last as long as the air conditioning systems in which they are used. And during their long life they continue to give dependable, *trouble-free* performance with a tested air filtering efficiency of 99.3% to 99.83%.

Cleaning and "charging" are simple, economical operations. After each inexpensive servicing the filters are again like new — saving you the expense of costly replacements.

The scientific AIR-MAZE design with its unique all-metal element is the secret of the increased efficiency and low operating cost of these permanent filter panels.



REMEMBER THESE FEATURES

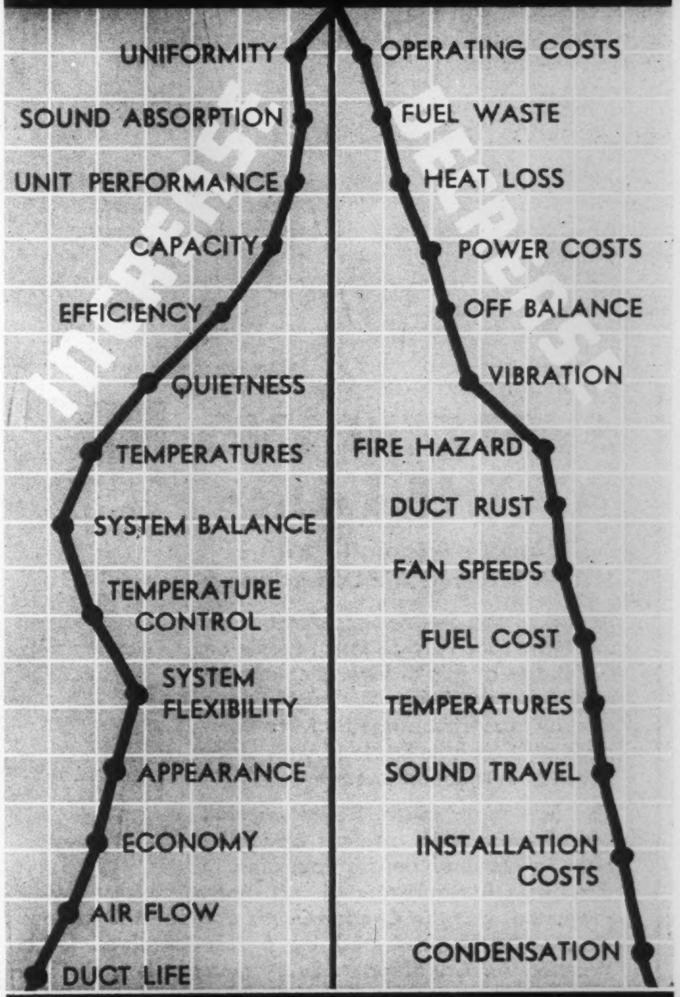
99.3% to 99.83% Efficient
Easily Cleaned and Charged
Extremely Low Pressure Drop
Long, Economical Service

Let us help you solve your air filtration problems. Write for Installation Planning Catalog PPS-38. No obligation.

AIR-MAZE CORPORATION
5200 HARVARD AVENUE • CLEVELAND, OHIO

AIR-MAZE
CLEANABLE
AIR FILTER PANELS

INSULATE EVERY
DUCT
with Asbestos Protected
DUX-SULATION
. . . FOR A BALANCED AND CONTROLLED OPERATION OF AIR CONDITIONING SYSTEMS


INCREASE
UNIFORMITY
SOUND ABSORPTION
UNIT PERFORMANCE
CAPACITY
EFFICIENCY
QUIETNESS
TEMPERATURES
SYSTEM BALANCE
TEMPERATURE CONTROL
SYSTEM FLEXIBILITY
APPEARANCE
ECONOMY
AIR FLOW
DUCT LIFE
DECREASE
OPERATING COSTS
FUEL WASTE
HEAT LOSS
POWER COSTS
OFF BALANCE
VIBRATION
FIRE HAZARD
DUCT RUST
FAN SPEEDS
FUEL COST
TEMPERATURES
SOUND TRAVEL
INSTALLATION COSTS
CONDENSATION

GRANT WILSON, INC.
4101 West Taylor Street CHICAGO

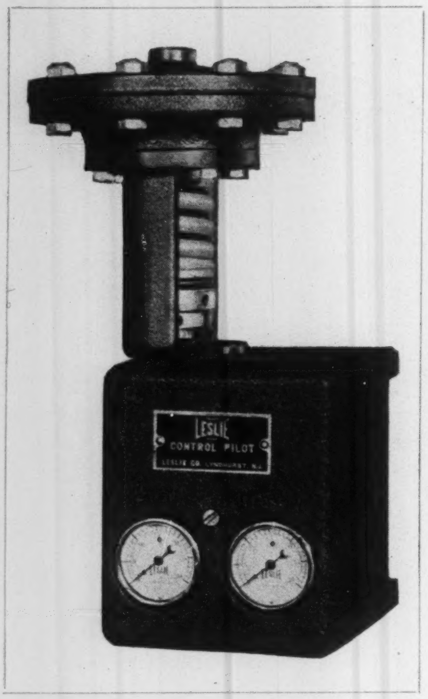
PLANT RUBBER & ASBESTOS WORKS
537 Brannan Street SAN FRANCISCO

AIR CONDITIONING UTILITIES CO.
8 West 40th Street NEW YORK

ATLAS ASBESTOS CO., LTD.
110 McGill St. MONTREAL, CANADA

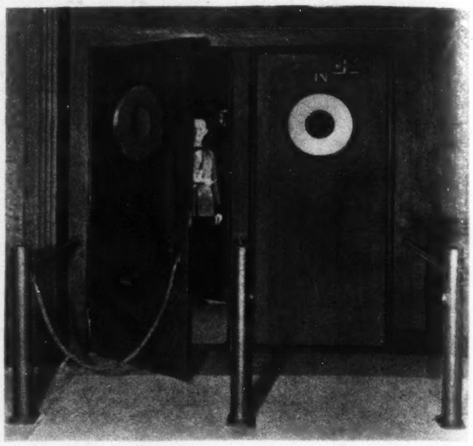
crease in controlled pressure decreases auxiliary pressure. This pilot is for use in controlling steam, air, water, oil and other fluids under pressure.

Applications include low pressure heating systems, high pressure make-up to low pressure exhaust systems, high pressure make-up for feed water heating, reduced pressure that must be constant under extremely varying load conditions, relief service where back pressure must be held constant, and for emergency supply systems.—Leslie Co., Lyndhurst, N. J.



Automatic Door Opener and Closer

No. 1697—The "Phantom Doorman" is the name of a new automatic door opener and closer designed for hinged doors, and offered by the manufacturer for use in air conditioned buildings to reduce to a minimum the period during which doors must remain open. It has applications in industrial work where humidities and temperatures within buildings must remain under accurate control also.

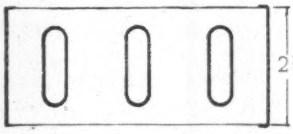


This door opener and closer, briefly described, is the manufacturer's regular door closer, visible or concealed, equipped with electric hydraulic controls which make it an automatic door opener as well as a closer. Hydraulic pressure supplied by a pump driven by an electric motor is applied to the piston of the closer which moves the piston, connected to the pinion shaft and door closer arm, in one direction to open the door. The hydraulic pressure is then relieved and the spring closes the door in the regular manner.—Yale & Towne Mfg. Co., Stamford, Conn.

Convectors for Hot Water Heating Systems

No. 1698*—The heating element of a new copper convector for hot water heating systems has large oval copper tubes with 2½ in. fins and a new type of wrought copper header. It is an addition to the manufacturer's line of convectors for one pipe steam, two pipe steam, vapor and vacuum systems.

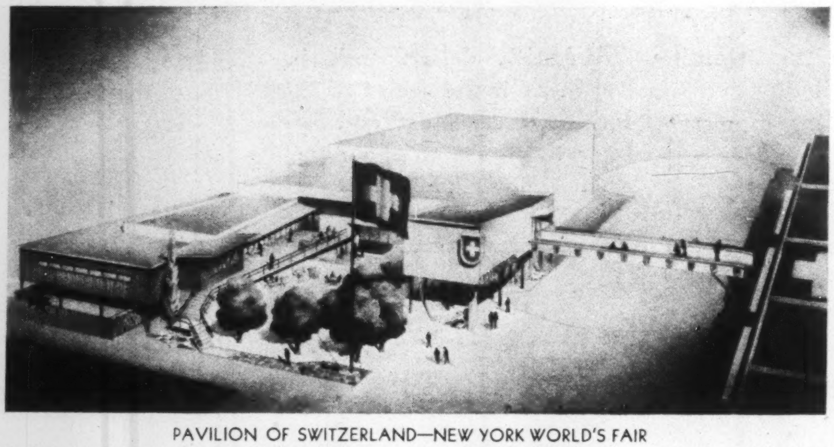
The diagram illustrates the tube arrangement in this new hot water heating unit.—Tuttle & Bailey, Inc., Corbin Ave., New Britain, Conn.



SWITZERLAND AT THE FAIR—

"Comfort-Cooled" with UTICA Washed Air Conditioning

A visit to the Switzerland Pavilion at the New York World's Fair reveals all the charm of this old-world country—and you can enjoy this picturesque display in surroundings that are completely "Comfort-Cooled" with Utica Washed Air Conditioners.



PAVILION OF SWITZERLAND—NEW YORK WORLD'S FAIR
Architects—William Lescaze and John R. Weber
Courtesy The Municipal Art Society of New York

You can linger in the Exhibition Hall where fascinating displays bring the real Switzerland before you, dine in the Swiss Restaurant and eat native dishes tastily prepared, visit the Cheese Caves and see the famous cheese flavor preserved by a self-contained Utica Washed Air Conditioner. Every moment is a thrill in an atmosphere that is refreshed by air that is washed, purified and circulated cool and clean.

Utica Washed Air Conditioners feature air purity—the air is throughly washed by a coarse rain spray and scrubbed clean before it is recirculated.

If your specifications call for Heating and Humidification or Cooling and Dehumidification, there is a Utica Air Conditioner to handle the job with complete automatic control. Easy to install, economical to operate, the Utica Washed Air Conditioner merits your attention.

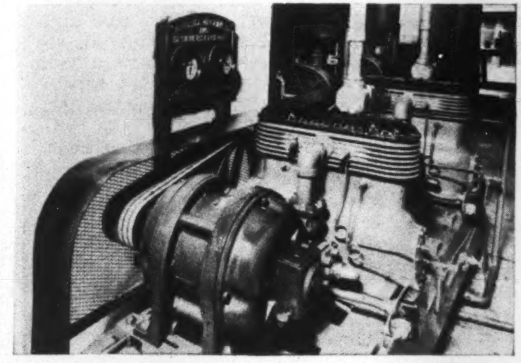
Visit our Exhibit—Home Building Center—New York World's Fair.

UTICA RADIATOR CORPORATION
Boilers • Radiators • Convectors • Air Conditioners
UTICA, N. Y.

BAKER Scores again in Rio!

FAMOUS COPACABANA PALACE HOTEL IN RIO DE JANEIRO INSTALLS BAKER SYSTEM AIR CONDITIONING!

Another famous name has been added to the list of outstanding air conditioning installations by BAKER in Rio de Janeiro. The distinguished Copacabana Palace Hotel selected BAKER equipment in preference to all others for its popular new grillroom. BAKER'S unfailing dependability, exceptional efficiency, and greater economy of operation were major considerations. Secure these advantages for your own air conditioning and refrigeration installations by specifying BAKER equipment.



Installation by Ceibrasil Representacoes, Ltda.

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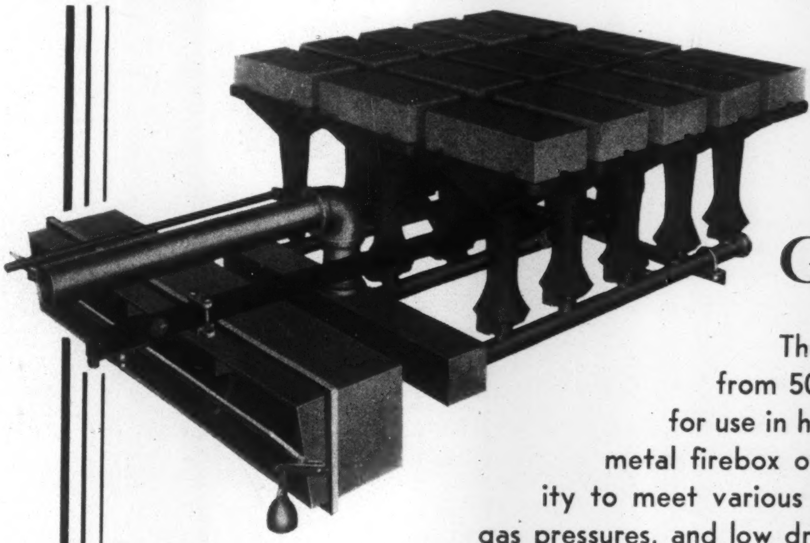
ICE MACHINE COMPANY, INC.

1508 Evans St., Omaha, Nebr.
Sales and Service in All Principal Cities

AUTHORITY ON MECHANICAL COOLING FOR 35 YEARS



WECO—N.G.E.
Series F600
GAS BURNERS

These burners are available for ratings from 50,000 to 10,000,000 B. T. U. output, for use in heating boilers, power boilers—in any metal firebox or sectional boiler. Featuring flexibility to meet various firebox shapes and sizes at various gas pressures, and low draft loss. Full automatic controls that operate properly can be easily applied.

GUARANTEED VIBRATIONLESS UNDER ANY LOAD CONDITION

This burner operates on straight natural gas and mixed gas to 800 B. T. U. Gives perfect horizontal distribution.

THE WEBSTER ENGINEERING CO.

TULSA —DIVISION OF— **OKLAHOMA**

Surface Combustion Corp. . . . . Toledo, Ohio

Bucket
on-a-
Track

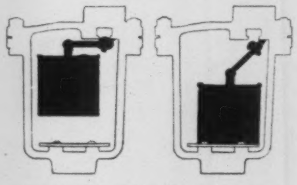
Anderson **SUPER-SILVERTOP** *Steam Trap* **GIVES POSITIVE VALVE CLOSING**

The "bucket-on-a-track" design of Anderson Super-Silvertops gives the user positive valve closing. In this engineered steam trap, positive valve closing is assured by tracking the bucket on a central tube. That control keeps bucket moving in a straight line, giving positive action, hence positive closing of the valve.

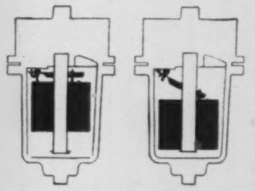
Lower initial cost of the trap is a further advantage of "bucket-on-a-track." The casing is smaller in diameter with guided bucket than with a conventional trap of the same capacity. This difference in diameter is clearly shown in the sketches at the left which compare a Super-Silvertop with a previous model, old style Anderson trap. Of course a smaller case means a less expensive trap.

Other features of Anderson Super-Silvertop are: simplified piping (straight through connection or as an elbow with no extra fittings to buy or install); ease of inspection (without removing trap from the line); increased capacity; clean, drilled passages that do not clog with scale; long life and trouble-free service.

Find out more about this Anderson Super-Silvertop steam trap—write today for full information.



Casing of old-style trap must be much larger diameter than bucket since bucket moves sideways as well as up and down.



Casing of Super-Silvertop needs to be only slightly larger in diameter than bucket. This means a smaller, lighter, less expensive steam trap for the same capacity.

THE
V. D. ANDERSON CO.
1949 W. 96th St., Cleveland, Ohio

Super-Silvertop
STEAM TRAPS

Rockefeller Center
is supplied with
Rust-free Hot Water by

Patterson

Copper-Lined Heaters

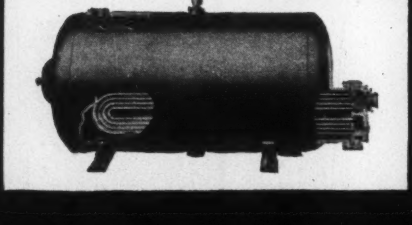
To insure the 25,000 tenants of the Rockefeller Center Buildings of a bountiful supply of rust-free hot water . . . even if they are in the 70 story R.C.A. Building, 850 ft. up in the air . . . 28 Patterson Indestructo Copper-Lined Hot Water Service and Storage Heaters were installed.

Be safe and use Patterson Copper-Lined or Everdur Heaters. They are guaranteed not to cause rust or red water and to furnish all the hot water required, as hot as required and as quickly as required.

The architects for this gigantic structure were Corbett, Harrison & MacMurray, Hood & Fouilhoux and Reinhard & Hofmeister, and the Consulting Engineer, Clyde R. Place.

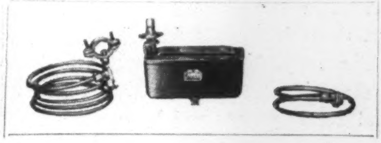
Write for our Catalog

The Patterson-Kelley Co., Inc.
107 Warren St., East Stroudsburg, Pa.



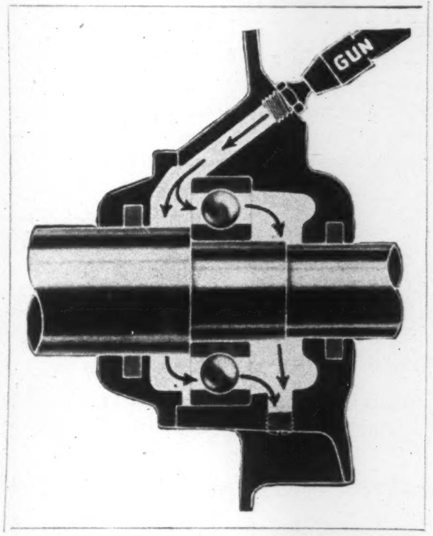
Feed Valve with Adjustable Water Line

No. 1699—A new "Water-Boy" feed valve with adjustable water line has been placed on the market for use with humidifiers. It is built of brass, copper, Monel and nickel silver, and the float operating the water feeder is housed in a nickel plated reservoir 2¼x2¼x6 in. in size. The feed outlet connected to the humidifier is fitted with a 3/16 in. OD copper tubing connector and 2 ft of 3/16 in. tubing to permit locating the feeder away from the heat to avoid corrosion.



The valve is guaranteed by the manufacturer to function on water pressures up to 85 lb.—Maid-O'-Mist, Inc., 180 N. Wacker Dr., Chicago, Ill.

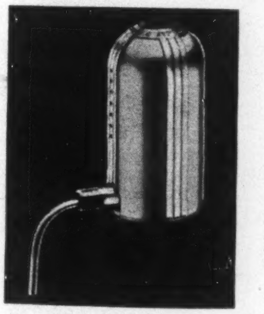
Lubricating Motor Bearings



No. 1700—The newly developed "Lubriflush" system of lubricating motor bearings has been designed to force out the old lubricant when new lubricant is injected. The new lubricant is injected to the inner side of the bearing with a pressure gun through a duct leading to the outside of the motor. As the new lubricant is injected, the old lubricant is forced out of the bearing through a drain.—U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles, Calif.

Automatic Air Valves

No. 1701—The "Airliner" adjustable venting air valve is available also in a non-adjustable type and in adjustable and non-adjustable vacuum types. In order to achieve rapid air venting without hissing, the port of the valve is within a shell which is designed to muffle the sound of the air. Velocity of the air is dissipated by expansion within the shell and it leaves the valve through multiple ports in the outer shell.



The design incorporates a baffle plate attached to the valve stem to prevent spraying or escape of water. To avoid spitting or spurting of water from the valve, there is a separate float chamber which is provided with small drainage ports and these small outlets are designed to give the ports a slower drainage than the valve body. In this way the valve body is permitted to drain completely before the vent is opened.—Jas. P. Marsh Corp., 2073 Southport Ave., Chicago, Ill.

Pushbutton Control Stations

No. 1702—A new line of standard duty pushbutton control stations is available in single and double button types. The enclosure consists of a reinforced bakelite cover mounted on a

"We now Use AP Valves Exclusively!

When Refrigeration Service Engineers and Jobbers tell us they "Now Use A-P Valves Exclusively," there's a story behind that "Choice" that bears repeating. They've "switched" to A-P as a remedy for expensive valve failures, or equipment inefficiencies, or to cut their service costs, or to assure more satisfied customers, or to eliminate frequent replacement.

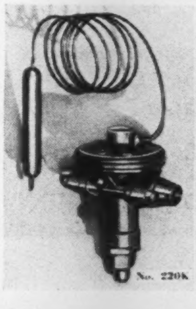
You'll find many such reasons for the popularity of A-P Valves. And they all come back to that well-known reputation for Dependable, Service-Free Performance—on every size and type of installation.

●

● Refrigeration Parts Jobbers, Who Recognize Quality, Stock A-P Valves

●

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN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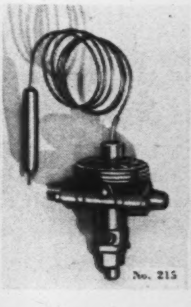
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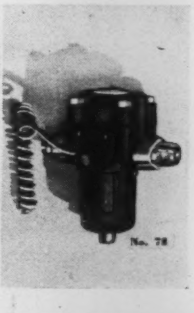

No. 78

DEPENDABLE
THE BYWORD FOR A-P VALVES

As Advertised in TIME
THE WEEKLY NEWSMAGAZINE
FEDDERS
Series 4
UNIT HEATERS

One of America's finest Unit Heaters . . . built by one of the oldest heat transfer specialists . . . used by foremost concerns everywhere.

Heating experts like Fedders streamlined tubes, non-clogging fins, handsome mono-piece cabinets to heat, ventilate factories, stores, garages, dairies, offices, hangars, churches, mills, laundries, recreation rooms, etc. . . . also process drying and dispelling fog. Write for Bulletin 573.

FEDDERS
MANUFACTURING CO., INC., BUFFALO, N. Y.

THE KEY MEN of Your Territory Will See This Series of FEDDERS UNIT HEATER Advertisements

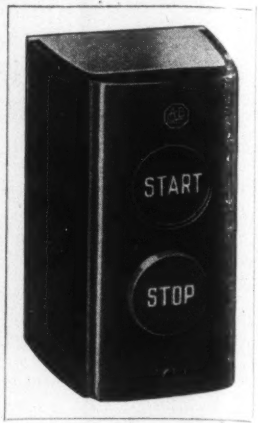
Key men of business and industry are getting quick facts about Fedders Unit Heaters through the advertising pages of TIME. With over a million men reading TIME, you will find that Fedders advertising is local advertising reaching the important men in your own territory who specify, buy and install Unit Heaters.

Exclusive streamlined tubes and non-clogging fins . . . full-floating element mounting for complete protection against expansion and misalignment . . . double headers providing large steam ways . . . rubber mounted motors and fans . . . handsome, mono-piece steel cabinets are just a few of the engineering features responsible for their performance. Handsome appearance adds the commercial market to the usual industrial market.

Write for Bulletin 573

FEDDERS MFG. CO. BUFFALO
HEAT TRANSFER SPECIALISTS SINCE 1896

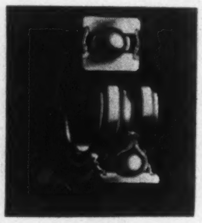
die-cast frame, the cover being furnished in black as standard, but also in machine tool gray or white. The double break silver contacts are located in recessed chambers to protect them from dust and dirt.



These pushbutton stations are available in both horizontal and vertical arrangements and have a maximum d-c rating of 1 ampere, 115 volts; 0.5 ampere, 230 volts; and 0.25 ampere, 550 volts. Maximum a-c rating is 3 ampere, 110-220-440-550 volts.—Allen-Bradley Co., 1335 S. First St., Milwaukee, Wis.

Sealed Ball Bearings

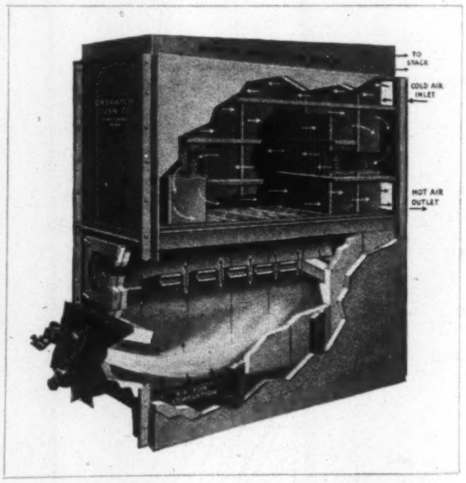
No. 1703—The seal used in a new line of ball bearings is one that can be applied to bearings having a standard single row SAE dimension of bore, inner and outer race width, which according to the manufacturer has not been possible before except through the use of small balls. This development has been evolved by sealing against dirt by felt fiber contact on the polished surfaces of the inner race, and by utilizing the tendency of deflected felt to resume its original flat shape.



Called the "Red Seal" bearing, it is available for shafts up to approximately 1 in. diameter and is suitable over a wide range of speed.—SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

Indirect Air Heater

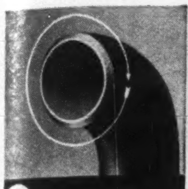
No. 1704—A new indirect air heater, which may be gas or oil fired, is recommended by the maker for ovens, dryers and space heating. Among its features is a new arrangement of the heat exchanger; there is an alloy cast protecting plate to shield the heat exchanger tubes from the radiant heat of the combustion chamber to assist in preventing burned out tubes.



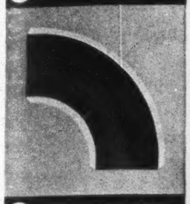
Only one burner is used to obtain 500,000 Btu rating. The burner equipment is of the low pressure proportioning type to keep a constant ratio between the air and the fuel, in order to promote efficiency and eliminate soot and dirt on the tubes. The combustion chamber is arranged to prevent flame impingement on the metal parts in order to prolong their life.—Despatch Oven Co., 600 Ninth St., S. E., Minneapolis, Minn.

Pneumatic Thermostat

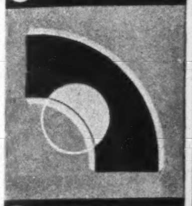
No. 1705—The new "Grad-U-Stat" pneumatic thermostat is of modern appearance and combines the following features, according to the manufacturer.



① SEAMLESS



② UNIFORMLY FULL PIPE THICKNESS



③ SELECTIVE, UNIFORM REINFORCEMENT

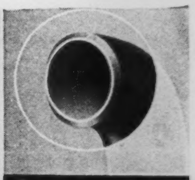
④ TANGENTS

YOU pay no more for the welding fittings that alone combine these eight features.

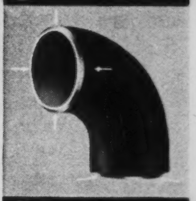
TAYLOR FORGE WeldELLS

Seamless Pipe Fittings for Welding

TAYLOR FORGE & PIPE WORKS
General Offices and Works: Chicago, P. O. Box 485 — New York Office: 50 Church Street



⑤ MACHINE TOOL BEVELLED



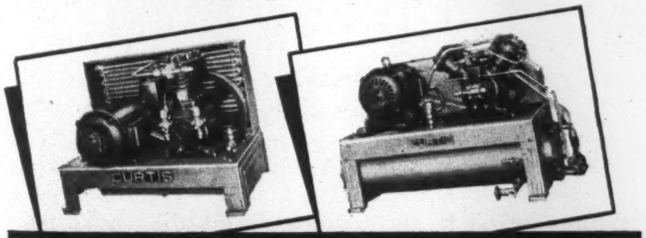
⑥ ENDS MARKED IN QUARTERS

⑦ COMPLETE IDENTIFYING MARKS ON EVERY FITTING

⑧ A FULL LINE

The Completeness of the CURTIS Line Assures the Correct Equipment for Every Air Conditioning or Refrigeration Need

Installation of Two Curtis Store and Office Coolers in the Sonice Buffet, New York City.



48 Air Cooled Units — 45 Water Cooled Units — 1/6 to 30 H.P.

CURTIS REFRIGERATION
AIR CONDITIONING AND COMMERCIAL

"Builders of Condensing Units Since 1926"

Curtis Refrigerating Machine Company
Division of Curtis Manufacturing Co.
1950 Kienlen Avenue, St. Louis, Mo.

WHETHER you buy, sell, install or specify air conditioning or refrigeration equipment, there's a Curtis unit that fulfills every requirement. Curtis covers a wide range of markets—makes possible greater sales. And you can specify Curtis products with absolute confidence.

The Curtis Store and Office Cooler fulfills the air conditioning demands of all classes of retail establishments. It's a complete, factory designed, packaged air conditioning unit. It mechanically cools, dehumidifies, circulates and filters the air — is quickly and easily installed with only water and electrical connections needed — adaptable for heating, too. It is offered in 3 and 5 ton sizes.

The Curtis Line of Condensing Units includes sizes from 1/6 H.P. to 30 tons air and water cooled — also unit coolers, coils, evaporative condensers, etc. Every Curtis product is precision engineered to deliver economical, efficient, care-free performance throughout an exceptionally long life.

HOW TO INSURE PRECISE TEMPERATURE CONTROL

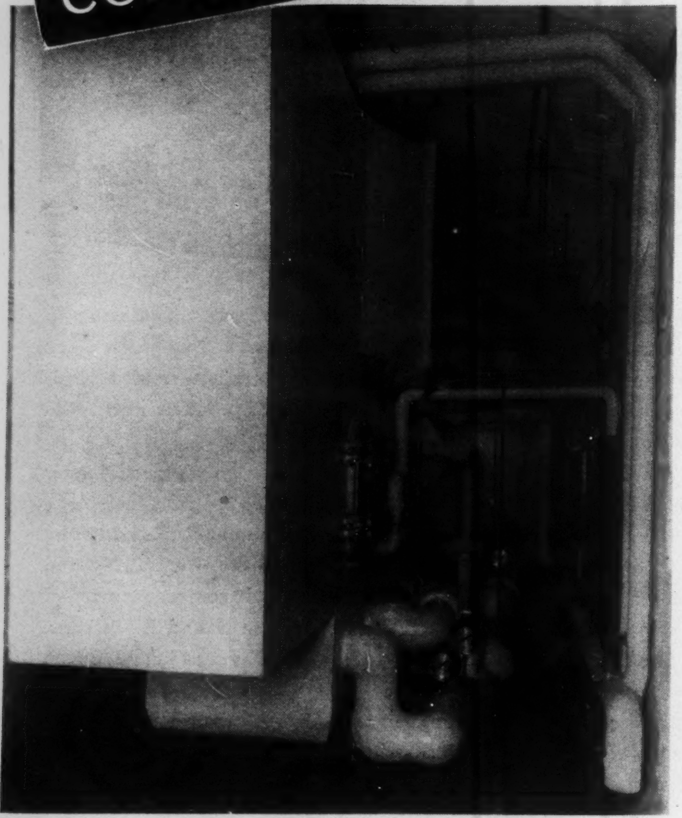
IN air conditioning, economical and precise control of temperature depends upon the efficiency and ADEQUACY of low-temperature insulation. Mundet Cork Insulation should be applied to air ducts, pipe lines, refrigeration equipment and all places where heat infiltration might occur.

Fabricated from pure cork, by the most improved methods, Mundet Corkboard and Moulded Cork Pipe Covering are guaranteed to give long and highly efficient service. To insure this performance, we offer Mundet Contract Installation, thru which all details of construction are arranged.

Mundet offices in principal cities give responsible, personal service. For suggestions and estimates covering the application of Mundet Cork Insulation, write to Mundet Cork Corporation, Insulation Division, 65 S. Eleventh St., Brooklyn, N. Y.

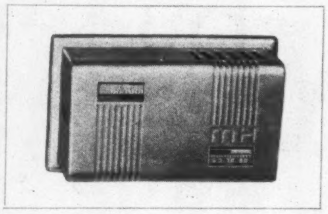
•*PREVENT VIBRATION TROUBLES by specifying Mundet Natural Cork Mats for fan foundations and motor mounts. Description sent promptly.*

FOR ALL LOW-TEMPERATURE
MUNDET
CORK INSULATION



Mundet Cork Insulation protects this air washer and pipe lines in the U. S. Marine Hospital, Savannah, Ga.

It is a non-leak type and uses air only when it is changing position of an air motor or valve. It is mounted horizontally to provide free flow of air over the bellows in order to make it sensitive to rapid changes in temperature.

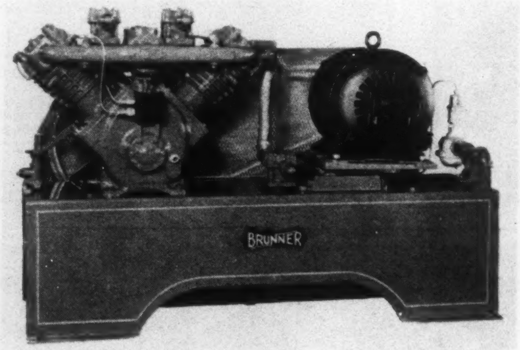


A single model of this thermostat may be used as a direct or reverse acting device and the throttling range may be adjusted between wide limits. Sub-master, day-night, and summer-winter models are available through the addition of a small unit to the standard model. The day-night thermostat requires only two air lines.

According to the maker, there is a straight line relation between temperature and air pressure in the branch line between 0 and 15 lb.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn.

New Condensing Units Extend Line

No. 1706—Two new and larger capacity condensing units—a 20 hp and a 25 hp model—announced last month extend the manufacturer's line so that it covers a range of equipment from ¼ to 25 hp. The new models follow the general construction of the maker's other units, but incorporate some changes due to the heavier duty.



The compressor is a four cylinder, v-type design, with cylinders at a 90 deg angle. Cylinders, pistons and connecting rods are of alloy cast irons and bronze bearings are used throughout. The new crankshaft design incorporates two connecting rods on one crank pin.

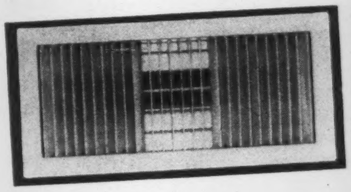
A special feature of the units is a suction manifold with strainer to prevent large particles of solder or weld from being drawn into the compressor. Condensers are of the shell and coil type, arranged to provide effective condensing through lowered head pressures and a high degree of sub-cooling of the liquid.—Brunner Mfg. Co., 1821 E. Broad St., Utica, N. Y.

Heating and Air Conditioning Calculator

No. 1707—A heating and air conditioning calculator has recently been developed and is designed to reduce complicated technical calculations to dial settings in order to simplify the work of technical men and make it possible for non-technical men to make such computations. With the calculator is furnished a set of instructions describing its uses.

The calculator has a number of circular scales, the user selecting factors pertaining to the particular job under consideration and reading the answers direct from the scales. The factors allowed for are design temperature difference, exposure, transmission factor, infiltration, dimensions, etc.

Heat losses can be read in Btu per hr, sq ft of steam radiation, or sq ft of hot water radiation. Btu per hr can be transferred direct to cfm for various air temperatures.—S. V. Dunagan, 9277 Pinehurst St., Detroit, Mich.



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Baltimore typifies the preference given Frick Air Conditioning by careful buyers everywhere. Let us refer you to Frick installations near you. Write

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Booklets, Reports and Papers

Fire Underwriters Issue Regulations

The National Board of Fire Underwriters, with offices at 85 John St., New York City, 222 W. Adams St., Chicago, and Merchants Exchange Bldg., San Francisco, has issued a new edition of NBFU Pamphlet No. 90 on Regulations for the Installation of Air Conditioning, Warm Air Heating, Air Cooling and Ventilating Systems as recommended by the National Fire Protection Association.

The NFPA revisions in its regulations for air conditioning systems, and the section on maintenance, which are the basis of this Underwriters' bulletin, were published on pp. 375 and 376 of the June, 1939, Heating, Piping and Air Conditioning.

Sound Insulation; Building Codes

Report BMS17 under the general title of Building Materials and Structures and issued by the National Bureau of Standards is on sound insulation of wall and floor constructions and was prepared by V. L. Chrisler. It summarizes data obtained in tests at the bureau on the sound transmission of wall, partition and floor panels, and gives a general discussion of the principles of sound insulation. Impact noises and methods of insulating against them is treated, and the importance of eliminating small openings which may almost completely destroy the sound insulating value of a wall is illustrated by examples.

Report BMS19 covers preparation and revision of building codes and was written by George N. Thompson. A description of how the work of preparing or revising building codes is done, and useful sources of technical information are given. Among the topics are basic principles, methods of presentation, advantages of using national standards, etc. Copies of the sound insulation report may be obtained from the Superintendent of Documents, Washington, D. C., for 10c, and copies of the building code report for 15c.

Design of Cooling Towers

A paper on fundamental relationships in the design of cooling towers was given by G. Russell Nance* at the semi-annual meeting of the American Society of Mechanical Engineers, San Francisco, July 10-15.

He presented a few theoretical considerations encountered when an attempt is made to correlate actual tower performance with that which may be predicted from thermodynamic considerations alone. The results of observed tests were correlated by means of empirical equations, with material to enable checking the performance of different types of towers with a fair degree of accuracy.

He concluded with a discussion in which information relative to the merits of various types of cooling systems was presented and gave suggestions as to the type of tower to install.

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*Mechanical Engineer, Fluor Corp., Ltd.

Handbook of Wood Pipe Practice

The Wood Pipe Handbook is a 269 page, 4¼x6¾ in. manual which treats the engineering features involved in the design, erection and operation of wood pipe lines. Sections are given on pipe line design, economics of wood pipe, preservative treatment, fittings, various types of wood pipe, hydraulics, pipe and flume flow tables, and wood tanks. In addition, there are 42 pages of reference tables.

The listed price of this manual, which is published by the National Tank & Pipe Co., 2301 N. Columbia Blvd., Portland, Ore., is $2.50.

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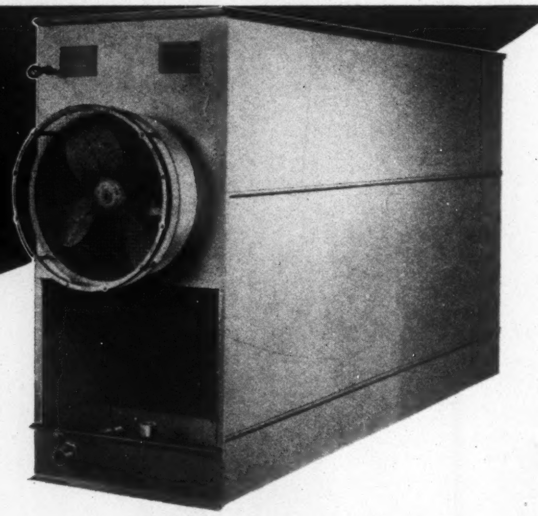

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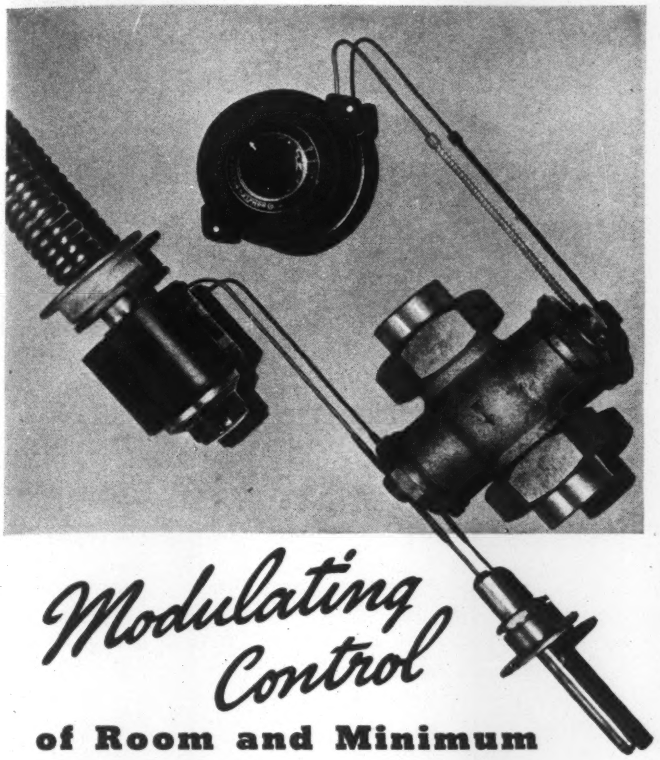
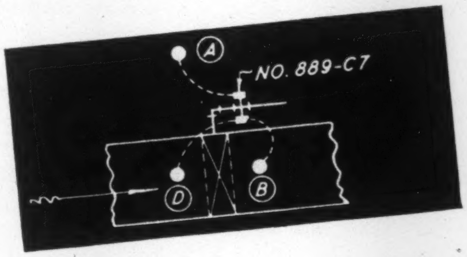


Modulating Control

of Room and Minimum Discharge air Temperature with a SINGLE INSTRUMENT



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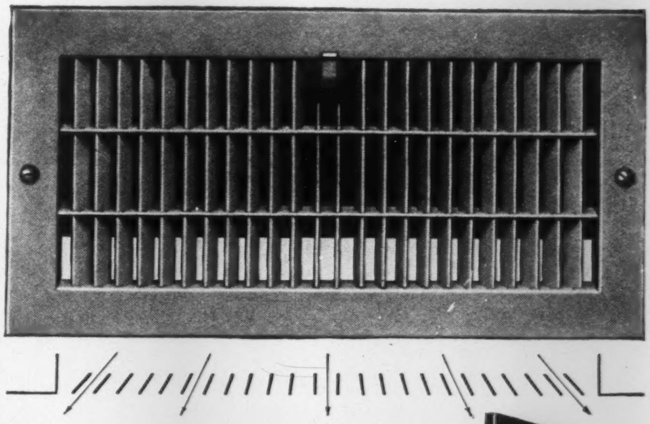

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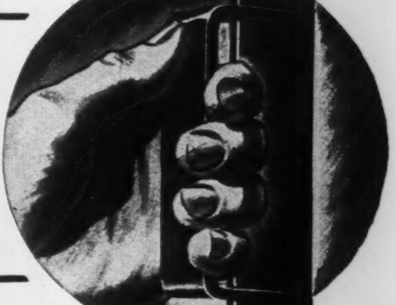

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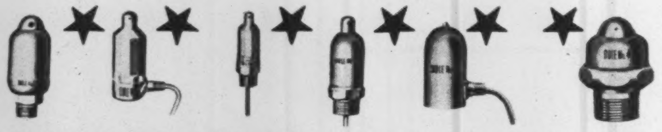
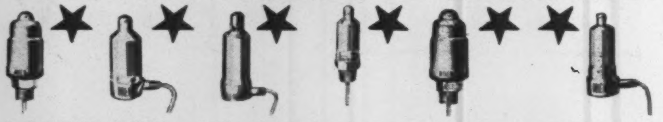


1C Quick-Vent Float Valve: For steam mains of automatically fired systems.—**3 Air Valve:** For general use on radiators of gravity systems. —**3A-B-C Air Valves (Straight Shank):** Three sizes for general use on mains, drop risers, pipe coils, convection and unit heaters in gravity systems.— **33 Air Valves (Straight Shank):** Low cost. Three sizes for general use.—**33 Angle Air Valve:** Low cost. Simplest positive acting valve for gravity steam radiators.—**4 Quick-Vent Valve:** For steam mains ending 18" or more above boiler waterline—for pressures up to 25 lbs.



5 Quick-Vent Valve: A float type for mains—any steam pressure up to 15 lbs.—**2B Vacuum Valve:** For radiators of vacuumized gravity steam systems.—**2B Vari-Vent Vacuum Valve:** For balancing steam distribution to radiators of vacuumized gravity steam systems.—**103 Vacuum Valve (Straight Shank):** For venting convectors, pipe coils, short mains, etc., of vacuumized gravity steam systems.—**6B Vacuum Valve:** For venting mains of vacuumized gravity steam systems.—**2 Vacuum Valve:** A low cost valve for venting radiators of gravity steam systems.

Dole Balancer: For automatically fired vacuum steam systems, especially with No. 2B Vari-Vent Vacuum Valves.—**14 Key Valve:** For concealed radiators and convectors of hot water heating systems.—**7 Signal Air Valve:** For venting concealed convectors and radiators of hot water systems.—**10 Hot Water Key Valve:** For general use on hot water systems.—**Dole Vent Lock:** For protection of valves against unauthorized removal or theft.—**Compound Pressure and Vacuum Gauge:** Ounce graduated—retard type.

DOLE

AIR AND VACUUM VALVES

Book Reviews

New Edition of Heating and Air Conditioning

["Heating and Air Conditioning," by John R. Allen, late past president, American Society of Heating and Ventilating Engineers, and James Herbert Walker, superintendent of central heating, Detroit Edison Co. 5th ed. 1939. 593 + vii pp., 6x9 in., clothbound. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Price, $4.50.]

The new edition of this valuable text was prepared in order to keep the book abreast of development in the art which has taken place in the four years since the previous edition was written. The more important revisions and additions are in the chapters related to air conditioning inasmuch as most of the progress has been in that field. A new feature is a chapter devoted to the complete step-by-step calculations and design of an air conditioning system, illustrating some of the practical problems encountered and the manner in which design principles are applied. This material was prepared by James N. Livermore, one of Mr. Walker's associates.

Chapters are included on heat and the properties of steam and air; heat losses from buildings; methods of heating; gravity warm air furnace heating; radiators, convectors, and unit heaters; fuels and boilers; steam heating systems; pipe, fittings, valves, and accessories; steam piping; hot water heating systems; automatic control; central and district heating—electric heating; air and its properties; principles of air conditioning; ventilating and air conditioning systems; fans, filters, washers, and coils; the transmission and distribution of air; cooling and dehumidifying apparatus; the cooling and dehumidifying load; the design of an air conditioning system; residence air conditioning; unit air conditioners; and industrial air conditioning.

There is also a 26 p. appendix of technical data.

ASTM Proceedings

["Proceedings of the Forty-First Annual Meeting of the American Society for Testing Materials," in two volumes, Part 1 (1392 pp.) including committee reports, new and revised tentative standards, and tentative revisions of standards, and Part 2 (675 pp.) comprising technical papers. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Price, $5.50 each in stiff paper cover, $6.00 in cloth, and $7.00 in half leather.]

Part 1 of the 1938 ASTM Proceedings includes reports of 50 committees outlining important standardization and research work, and some 162 specifications and tests prepared for the first time in 1938 or revised.

Part 2 includes 45 technical papers and in addition, the Edgar Marburg lecture on the torsion test.

Industrial Market Data Handbook

["Industrial Market Data Handbook of the United States," by O. C. Holleran, Chief, Industrial Marketing Unit, Marketing Research Division, Bureau of Foreign and Domestic Commerce. 1939. 907 + iv pp., 9 x 11½ in., buckram. For sale by the Superintendent of Documents, Washington, D. C. Price, $2.50.]

This handbook represents an effort to assemble for each of the 3071 counties of the United States the basic statistical facts upon which manufacturers of industrial goods and supplies may build their individual market studies, and thereby measure the possibility of economical and profitable distribution of their merchandise in every section and industry of the country. The volume is a joint activity of the Bureau of the Census, the Bureau of Mines of the Department of the Interior, and the Bureau of Foreign and Domestic Commerce.

It comprises some 15 tables, and in addition an introduction and a bibliography of industrial marketing. The tables include:

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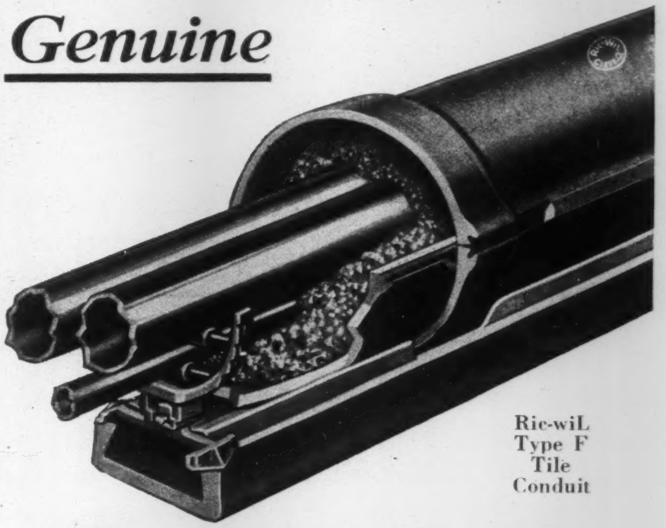

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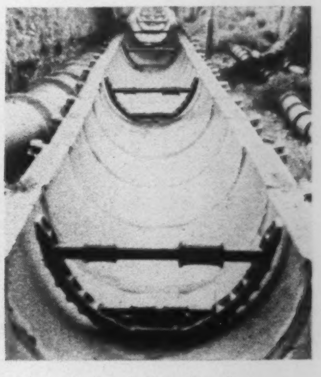

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summary for manufacturing industries, 1935, and number of motor trucks registered July 1, 1936, by states and counties; manufacturing industries—summary for cities of 10,000 population and over, by geographic division and states; location of manufacturing industries by state and county and type of industry, 1935; summaries of manufacturers, 1935, by industry groups, industries, and industrial areas; distribution of manufacturers' sales, 1935—number of plants selling through various distribution channels by industry groups, comparison between channels of primary distribution used in 1935 and 1929 by industry groups, summary of primary channels of distribution by industry groups, and summary of distribution expenses by industry groups; summary of full service and limited function wholesalers for selected lines by state and county, 1935; number of establishments, wage earners, wages, expenditures for supplies and materials, and value of products in all mining industries and in metal mining industries by states and counties, 1935; summary for coal mining, 1935, by states and counties; value of products, mine and mill expenditures, and employment at iron ore mines and beneficiating plants in 1935 by states; and location of mining industries by state and county and by type of mine, 1935.

Service Engineers' Handbook

["Second Annual Year Book of the Refrigeration Service Engineers Society." 1939. 96 pp., 6x9 in., paper bound. Published by Refrigeration Service Engineers Society, 435 N. Waller Ave., Chicago, Ill. Price, $1.50.]

The second annual year book of the RSES includes a membership list, directory of chapters, and other information about the Society and in addition a number of technical papers on pressure drop in suction lines, dryers and drying agents, refrigerant and oil data, balancing cooling coil and condensing unit, requirements of refrigerating oils, and accident prevention and first aid in refrigeration service.

Tables on a number of refrigerants used in air conditioning and refrigerating work are given, together with tables of temperature-pressure relations of common refrigerants, thermostat settings, pressure control settings, temperature conversions, and altitude corrections for gage readings.

Conventions and Expositions

National Industrial Advertisers Association: 1939 national conference, September 20-22, Hotel New Yorker, New York, N. Y. General chairman, Edward A. Phoenix, Johns-Manville Corp., New York, N. Y.

Exposition of Building, Industry and Services: October 4-6, Hotel Statler, Detroit, Mich. (concurrently with annual convention of Mortgage Bankers Association of America). Secretary-Treasurer, George H. Patterson, 111 W. Washington St., Chicago, Ill.

Joint meeting, Fuels Division, American Society of Mechanical Engineers, and Coal Division, American Institute of Mining and Metallurgical Engineers: October 5-7, Deshler-Wallick Hotel, Columbus, Ohio. Chairman, R. A. Sherman, Battelle Memorial Institute, Columbus, Ohio. Papers to be given on coördination of fuel engineering, a proposed code for testing coal, and recent developments in equipment for burning anthracite coal.

American Gas Association: Annual convention, October 9-12, Hotel Pennsylvania, New York, N. Y. Headquarters Office, 420 Lexington Ave., New York, N. Y.

American Public Health Association: Annual meeting, October 17-20, Hotel William Penn, Pittsburgh, Pa. Headquarters office, 50 W. 50th St., New York, N. Y.

American Welding Society: Annual meeting, week of October 22, Stevens Hotel, Chicago, Ill. Headquarters office, 33 W. 39th St., New York, N. Y. Papers to be presented include Oxyacetylene Welding of Red Brass Pipe, by A. N. Kugler; 90 Deg

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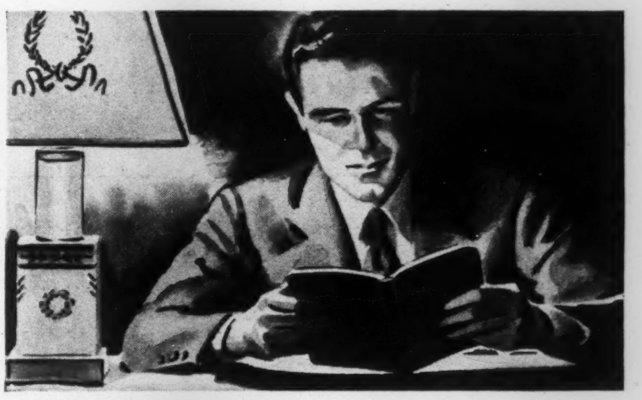

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☐ Fire Bosses
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BUSINESS SUBJECTS

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Canadian residents send coupon to International Correspondence Schools Canadian, Limited, Montreal, Canada. British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England.

Welded Nozzles, Piping Calculations, Design and Fabrication, by F. C. Fantz and W. G. Hooper; Extensions of Fusion Welding in Special Pipe and Pipe Fitting Applications, by E. Hall Taylor; and Welding in the Manufacture of Valves for High Pressures and Temperatures, by W. F. Crawford.

National Metals Exposition: Week of October 22, International Amphitheater, Chicago, Ill.

Symposium on Measurement and Control of Temperature: November 2-4, New York, N. Y. Temperature Symposium Committee, American Institute of Physics, 175 Fifth Ave., New York, N. Y.

Air Conditioning Conference: November 10-11, Lehigh University, Bethlehem, Pa., under sponsorship of American Society of Refrigerating Engineers. Includes sessions on industrial air conditioning; air conditioning of perishables; air conditioning of hospitals, apartments, and hotels; and air conditioning in transportation. Chairman, Prof. B. E. Jennings, Lehigh University, Bethlehem, Pa.

American Society of Mechanical Engineers: Annual meeting, December 4-8, Philadelphia, Pa. Headquarters office, 29 W. 39th St., New York, N. Y.

Refrigeration Service Engineers Society: Annual convention, January 15-18, Chicago, Ill. Secretary, H. T. McDermott, 433 N. Waller Ave., Chicago, Ill.

Refrigeration and Air Conditioning Exhibition: January 15-18, Stevens Hotel, Chicago, Ill. Exhibition manager, R. M. McClure, 111 W. Washington St., Chicago, Ill.

American Society of Refrigerating Engineers: Annual meeting, January 16-19, Blackstone Hotel, Chicago, Ill. Secretary, D. L. Fiske, 37 W. 39th St., New York, N. Y.

American Society of Heating and Ventilating Engineers: Annual meeting, January 22-26, 1940, Hotel Statler, Cleveland, Ohio. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Sixth International Heating and Ventilating Exposition: January 22-26, 1940, Cleveland Public Hall, Cleveland, Ohio. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

National Warm Air Heating and Air Conditioning Association: Annual convention, January 22-24, Hotel Hollenden, Cleveland, Ohio. Managing Director, Allen W. Williams, 5 E. Long St., Columbus, Ohio.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 128. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 3271. AIR CONDITIONERS: Frick Co., Waynesboro, Pa. 4 p. issue of the "Frick System" (Vol. 11, No. 2) illustrating and describing installations of air conditioners in restaurants, stores, offices, plants, etc.

No. 3272. AIR CONDITIONING: Carrier Corp., 302 S. Geddes St., Syracuse, N. Y. 12 p. booklet giving a complete list of air conditioned public spaces in Greater New York where this manufacturer's equipment is used.

No. 3273. AIR FILTERS: Air-Maze Corp., 5200 Harvard Ave., Cleveland, Ohio. Looseleaf bulletin on industrial air filters of the heavy duty oil bath and multimaze types describing features, giving technical details, and showing applications.

No. 3274. AIR VALVES: Jas. P. Marsh Corp., 2073 Southport Ave., Chicago, Ill. 4 p. condensed catalog and price sheet covering syphon automatic air valves, vacuum valves and vents, with particular attention to new features.

JANUARY

1940

. . . will be a **BIG** *month for the industry!*

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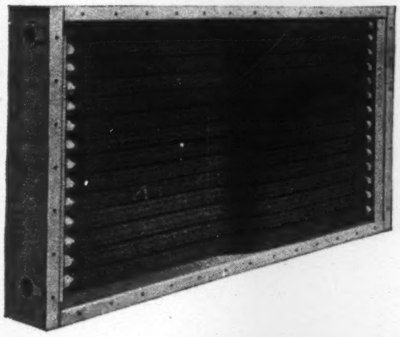

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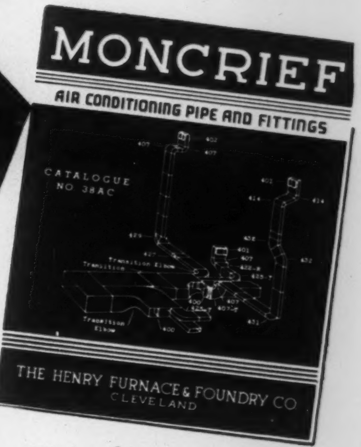
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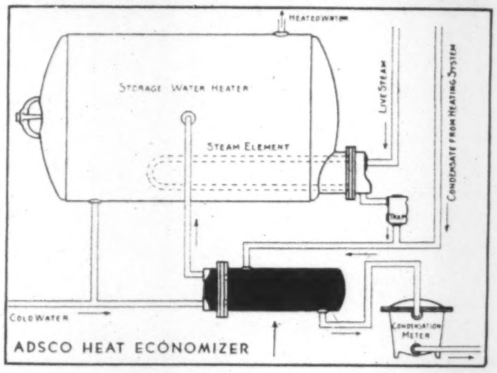
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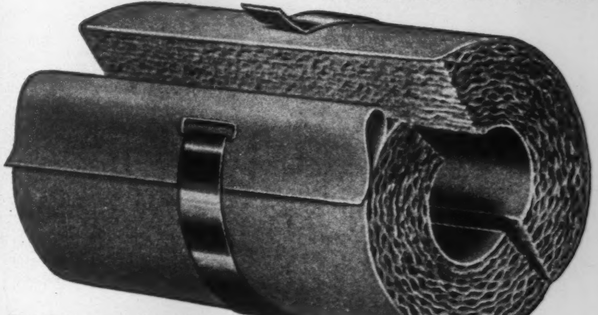

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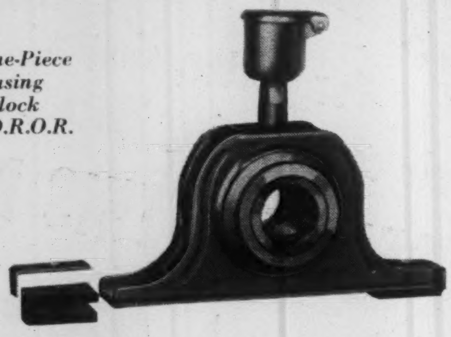

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No. 3275. ALLOYS: Climax Molybdenum Co., 500 Fifth Ave., New York, N. Y. Issue of the "Moly Matrix" (Vol. 6, No. 7) including a report on an investigation of the creep strength of 5 per cent chromium steel.

No. 3276. AMMONIA EXPANSION VALVES: Alco Valve Co., Inc., 2622 Big Bend Blvd., St. Louis, Mo. 12 p. bulletin (Section 172) and price list on thermostatic expansion valves and automatic constant pressure expansion valves with information on operation and complete details.

No. 3277. BLOWER WHEELS: Janette Mfg. Co., 556 W. Monroe St., Chicago, Ill. Leaflet on blower wheels for stokers, oil burners, air conditioners, etc., available in eight diameters and nine widths.

No. 3278. COMPRESSORS: Trane Co., La Crosse, Wis. 12 p. bulletin (S399) describing in detail the new "Turbovac" self contained water chilling unit for air conditioning, with cross section view, explanation of operation, mechanical specifications, etc.

No. 3279. EXPANSION JOINTS: American District Steam Co., Bryant St., North Tonawanda, N. Y. 12 p. bulletin (35-15A) on "Adsco" piston ring expansion joints which can be unpacked and repacked under operating pressure.

No. 3280. FLEXIBLE COUPLINGS: Certified Flexible Couplings, Inc., 122 E. 42nd St., New York, N. Y. 6 p. pamphlet describing additions to line of flexible couplings for low power drives.

No. 3281. FLOAT SWITCHES: Alco Valve Co., Inc., 2622 Big Bend Blvd., St. Louis, Mo. 8 p. bulletin (Section 175) and price list on float switches for "Freon", methyl chloride, ammonia, and carbon dioxide.

No. 3282. FLOAT VALVES: Alco Valve Co., Inc., 2622 Big Bend Blvd., St. Louis, Mo. 4 p. bulletin (Section 176) on high pressure float valves for "Freon", methyl chloride, and ammonia.

No. 3283. FORMING MACHINES: Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. 14 p. bulletin (77-A) on hand and power operated slip roll forming machines for sheet metal.

No. 3284. GASKETS: Metallo Gasket Co., 16 Bethany St., New Brunswick, N. J. 16 p. reprint from Sweet's catalog file (40) covering standard round gaskets, special gaskets, raschig rings, and giving dimensions and list prices.

No. 3285. HEATING: C. A. Dunham Co., 450 E. Ohio St., Chicago, Ill. 24 p. booklet on "comfort conditioning" giving a non-technical discussion of the principles and applications of the manufacturer's method of sub-atmospheric steam heating. Transparent window pages illustrate the method of temperature control.

No. 3286. HOT WATER CIRCULATORS: Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, Minn. Leaflet describing features of packless seal hot water circulators.

No. 3287. INSTRUMENTS AND CONTROLS: Julien P. Friez & Sons, 4 N. Central Ave., Baltimore, Md. 24 p. bulletin or condensed catalog (K) on heating, refrigeration and air conditioning instruments and controls, illustrating and giving details on a complete line.

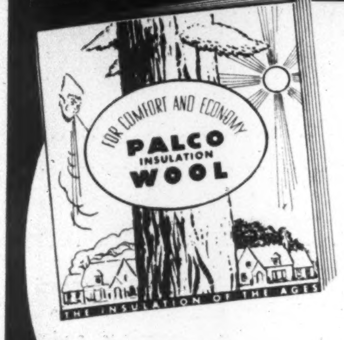
No. 3288. METAL TREATMENT: Mar-Nel Chemicals, Bedford Sta., Detroit, Mich. Leaflet describing "Galv-A-Niel" treatment for new and old galvanized metal and zinc die castings to assure adhesion of paint film.

No. 3289. MOTOR CONTROL: Cutler-Hammer, Inc., N. 12th St. and W. St. Paul Ave., Milwaukee, Wis. 24 p. booklet entitled "Dust the Destroyer", discussing the advantages of vertical contacts in motor control equipment.

No. 3290. MOTORS: General Electric Co., 1 River Rd., Schenectady, N. Y. 4 p. bulletin (GEA-2420) on capacitor motors for vacuum heating, refrigerant, sump, deep well and other pumps, covering ratings, advantages, operation, construction, and control.

No. 3291. MOTORS: Westinghouse Electric & Mfg. Co.,

Fortify your Equipment
with **PALCO WOOL**
.255 B.t.u. **EFFICIENCY**



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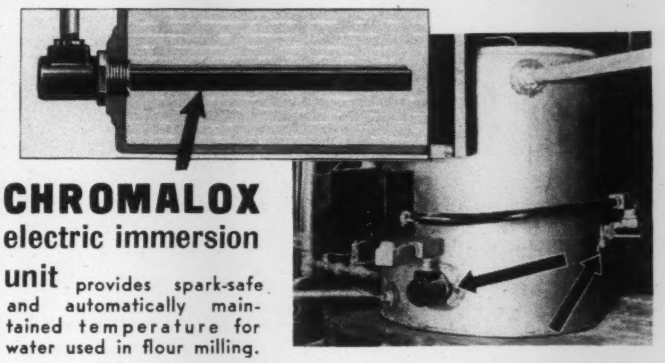
ELECTRIC HEAT for tank, cuts dust-explosion hazard



CHROMALOX electric immersion unit provides spark-safe and automatically maintained temperature for water used in flour milling.

Dust-laden air is a natural condition in a flour mill. When the manager of a certain mill found it necessary to use water at 120 deg. unvarying temperature, he met both the dust condition and the water temperature need, with Chromalox electric immersion units of the type which screw into a tapped hole in the side of the tank. A thermostat accurately maintains the temperature without attention of any kind.

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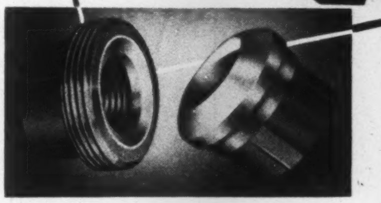

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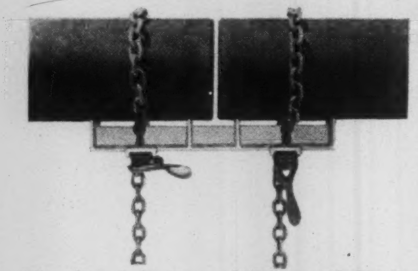

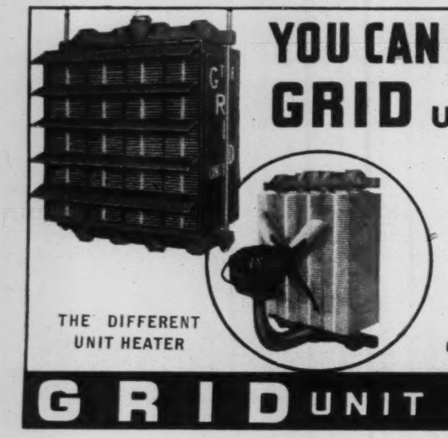

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Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1692	1693	1694	1695	1696	1697	1698
1699	1700	1701	1702	1703	1704	1705
1706	1707					
3271	3272	3273	3274	3275	3276	3277
3278	3279	3280	3281	3282	3283	3284
3285	3286	3287	3288	3289	3290	3291
3292	3293	3294	3295	3296	3297	3298
3299	3300	3301				

Name .... Title..........
Company ....
Address ....
City .... State..........

East Pittsburgh, Pa. 6 p. booklet (F-8485) describing capacitor motors of 1/20 to ¾ hp for unit heater, fan, and blower applications, showing cutaway drawings, outline dimensions, and typical installations.

No. 3292. PILLOW BLOCKS: Stephens-Adamson Mfg. Co., Bearing Div., Aurora, Ill. 8 p. catalog (739) on "Seal Master" ball bearing pillow blocks, flange units, and take up units which are permanently sealed, pre-lubricated, and self-aligning.

No. 3293. POWER TRANSMISSION: Morse Chain Co., Turner Pl., Ithaca, N. Y. 12 p. bulletin (75) of power transmission data including announcement and design data on new round pin roller chain, information on silent chain drives, and other products.

No. 3294. PUMPS: Nash Engineering Co., South Norwalk, Conn. 8 p. bulletin (313) describing new centrifugal pump of "Pyrex" brand heat, shock and acid resistant glass for handling corrosive acids and chemical fluids.

No. 3295. PUMPS: Peerless Pump Div., Food Machinery Corp., 301 W. Ave. 26, Los Angeles, Calif. Bulletin describing improved water lubricated pump, showing a cross-section of the entire pump assembly. Units are available in capacities up to 10,000 gpm.

No. 3296. ROOM VENTILATION: Carrier Corp., 302 S. Geddes St., Syracuse, N. Y. Broadside describing new room ventilator for window sill or transom space mounting in offices, apartments, hospitals, stores, hotels, factories, and homes, available in two sizes and models.

No. 3297. RUBBER PRODUCTS FOR INDUSTRY: Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J. 56 p. condensed catalog of mechanical rubber products, including belts, hose, packing, molded goods, friction material, rubber covering, and abrasive wheels, with transmission belt engineering data and other technical information.

No. 3298. UNIT HEATERS: Carrier Corp., 302 S. Geddes St., Syracuse, N. Y. 4 p. bulletin on gas fired unit heaters in duct and suspended types, also available in a new floor model. Units may be had for use in garages and airplane hangars.

No. 3299. WELDING: Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio. Photo review of welding progress showing many interesting applications and illustrating welding equipment and welding aids.

No. 3300. WELDING EQUIPMENT: Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill. 24 p. catalog (334) on welding, cutting, brazing, and lead burning equipment, soldering equipment, gas and air torches, and welding supplies, including several new items.

No. 3301. WRENCHES: Lowell Wrench Co., Worcester, Mass. 4 p. bulletin describing 24 in. "safety-steel" reversible ratchet wrench tested by the maker to stand a pull of 2200 to 2400 lb.

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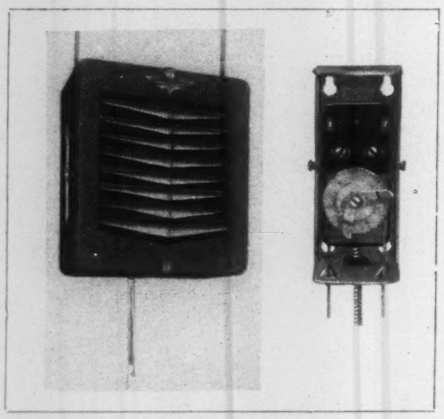
Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 126. Add the new products and companies listed here to your Directory Section which you received in your January, 1939, HEATING, PIPING AND AIR CONDITIONING and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.

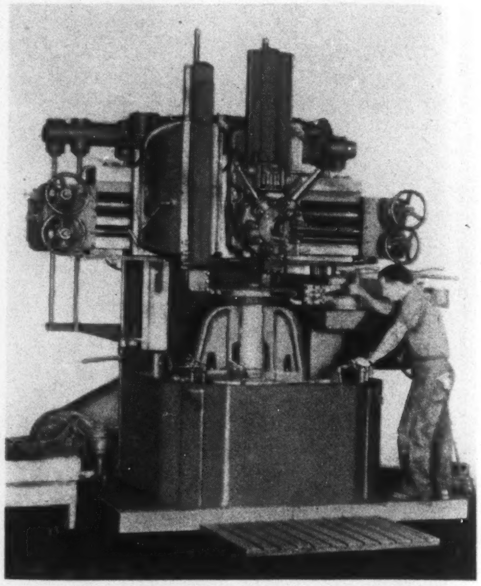
Unit Heater with Built-In Control



No. 1708—Built-in individual automatic control of both day and night temperatures is provided in the "Automatic Thermolier" unit heaters. The control may be added to existing unit heaters of any make, as it requires only to be tied into the line at the heater itself.

Heart of the device is a bulb thermostat, containing a solid liquid charge, mounted within the heater housing. Two pointers—one for day, one for night — are adjusted over a 60 deg range and locked in position. Thereafter, day and night settings are made by a pull cord control hanging from the heater. A special setting makes possible summer operation of the fan alone under thermostatic control, without additional wiring or other changes.—Grinnell Co., Inc., 260 W. Exchange, Providence, R. I.

Vertical Turret Lathe



No. 1709—The new "Cut Master" vertical turret lathe is a machine which has been designed primarily for cutting time on cuts as well as time between cuts, and it is available in a range of five sizes—30, 36, 42, 54 and 64 in. The machines are designed to conform to the utmost capabilities of modern carbide and other cutting tools with a wide range of feeds and speeds plus the ability to stand up under high horsepower loads. Because of their versatility, these machines obviate the need for special tools for limited runs. With the exception of the 30 and 36 in. machines, which are designed for two heads—a main turret head and a side head—these units are designed to carry

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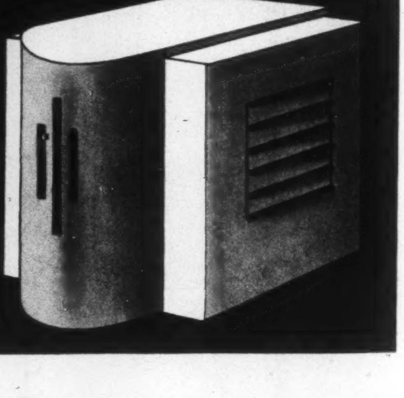

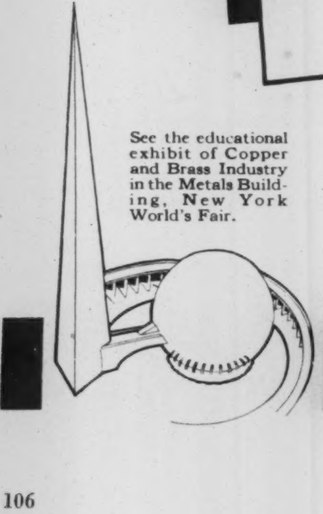

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HERE is the first book to treat exhaustively of the industrial applications of air conditioning. In a clear, well-ordered treatment, it discusses the need for and value of air conditioning in the textile, ceramic, leather, food, chemical, brewing, baking, paper-board, process, flour, printing, motion-picture, glass-making, and numerous other industries. It shows how air conditioning has improved products, saved money, and in general become an indispensable part of efficient manufacturing processes.

Compiled principally from material published originally in HEATING, PIPING and AIR CONDITIONING, this volume embodies the accumulated practical knowledge of 25 outstanding air conditioning specialists. Every phase of the whole subject of industrial air conditioning—from fundamentals and equipment, through the design, installation, operation, and maintenance of the different types of systems, and the problems relating to each—is explained thoroughly and plainly by these men from the standpoint of their successful experience.

There is a world of practical, authoritative information in this book for everyone interested in industrial air conditioning. Whether you are an operating, consulting, designing, or contracting engineer, or a student of the subject, you may turn to this book for reliable facts on almost any industrial air conditioning question you want answered or any problem you may have to solve.

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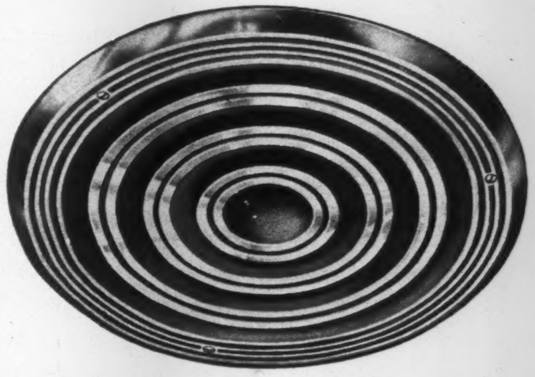
AEROFUSE OUTLET



- ★ **MAXIMUM AIR MIXTURE**
- ★ **RAPID TEMPERATURE EQUALIZATION**
- ★ **PERFECT AIR DISTRIBUTION**
- ★ **TOTAL ELIMINATION OF DRAFTS**

A truly flush type of ceiling diffuser which can be used with any style of interior decoration. Air distribution is based on an entirely new principle, offering the utmost efficiency in performance. The Aerofuse Outlet is constructed of a series of specially shaped cast aluminum rings. It is easily handled and quickly installed. Simplified construction makes surprisingly low price possible.

Send for fully illustrated brochure giving complete details of performance, construction, installation and price.

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NEW BRITAIN, CONN.

three heads—left hand main ram head, right hand main turret head, and the side head. However, any choice of heads is available to meet individual requirements.

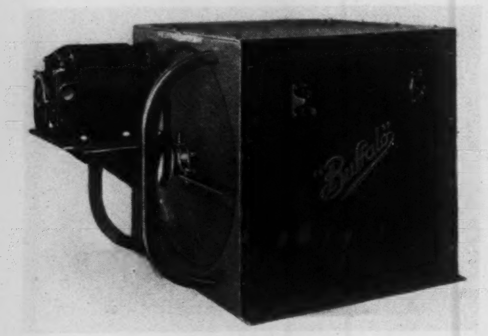
All heads and functions of the machines are protected by interlocking and limit switches, either rail head may be swivelled 30 deg either side of vertical center for machining angular surfaces, and the heads can also be fed horizontally and their respective rams fed vertically at the same time for machining any angles up to 45 deg. Furthermore, if the main heads are set at angles varying up to 30 deg off vertical center and the heads and rams given their respective feeds, angles ranging up to 60 deg may be produced.

Because of the postponement of the machine tool show, three of these machines—the 30, 42 and 64 in.—are running in the manufacturer's plant and are available for inspection.—Bullard Co., 286 Canfield Ave., Bridgeport, Conn.

Exhaust Fans

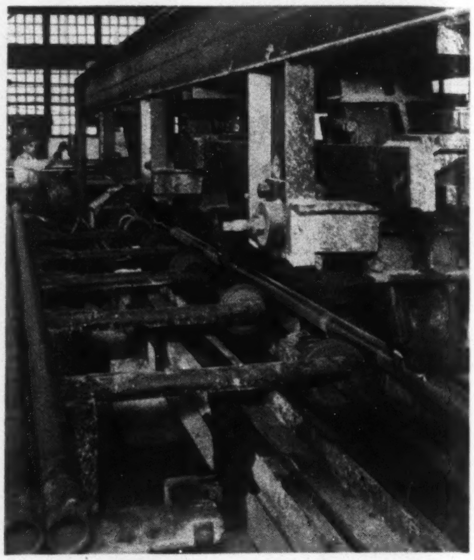
No. 1710—The new "Breezo" propeller type fans illustrated are offered for use where the motor must be outside the air stream, in exhausting from paint spray booths, over kitchen and laboratory hoods, in chemical plants, etc. The units have capacity for resistances up to ¼ in. static.

The motor, v-belt, pulleys and one bearing are entirely outside of the air path, and the bearing at the fan end of the shaft which is in the air chamber is of bronze, and enclosed and wool packed, requiring oiling about once every 2000 hr of use. Where desired, enclosed ball bearings packed in grease can be furnished. Housings are designed so that the air inlet may be at top, bottom or either side and may be changed from one to another on the job if necessary.—Buffalo Forge Co., 171 Mortimer St., Buffalo, N. Y.



Cement Lined Steel Pipe

No. 1711*—An improved process for the manufacture of cement lined steel pipe for the transmission of highly corrosive fluids was announced last month and initial shipments of the pipe have been made to coal mines for sulphur water disposal systems and to oil fields for salt water disposal lines. The product is made on a high speed mill especially designed for the purpose; one of the features of the plant is a pilot ball mill in which the trial batches of the pipe lining mix are ground in order to determine the correct formula for each specific application.



CERTAINLY, WE'VE GOT TO LINE THESE DUCTS...

"FOR QUIET...

We don't want any complaints about noise after this system is installed. We can line the ducts now with Airacoustic Sheets, without adding much to the cost of the job. They soak up more than 70% of all sounds in the duct. What's more, the system needs Airacoustic Sheets . . .

"FOR FIRE-SAFETY...

The National Board of Fire Underwriters has reported too many cases where combustible duct linings have caused serious fire losses. Airacoustic Sheets minimize this risk because they are basically mineral and will not contribute to the spread of fire."

You can use J-M Airacoustic Sheets for lining any type of duct. They are easy and economical to apply. And, once installed, the job is really finished. Humidity offers no costly maintenance problem, for Airacoustic Sheets are exceptionally moisture-resistant. They combine high transverse strength with low heat conductivity. You should have full details. Write Johns-Manville, 22 East 40th Street, New York, N.Y.

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WeldELLS

① SEAMLESS
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④ TANGENTS
⑤ MACHINE TOOL BEVELLED
⑥ ENDS MARKED IN QUARTERS
⑦ COMPLETE IDENTIFYING MARKS ON EVERY FITTING
⑧ A FULL LINE

● You who know welding fittings can see in these features of WeldELLS the short cut to faster, better, lower cost pipe welding. WeldELLS alone have all eight.

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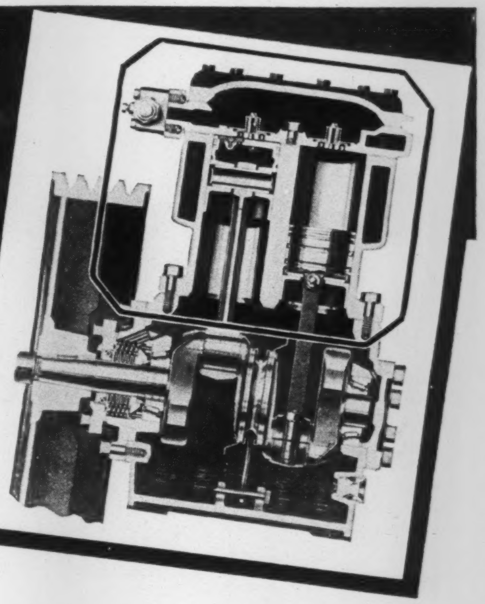
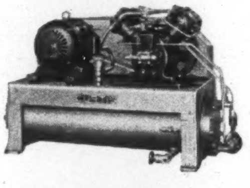
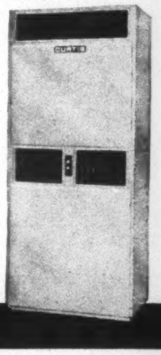
CURTIS Water Jacketed Cylinders Increase Efficiency of Larger Capacity Units



The Curtis Line includes condensing units from 1/6 to 30 H. P., both air and water cooled, but all Curtis compressors above 5 H. P. are water cooled for increased efficiency and lowered operating costs. The prime purpose of the unit is to effect the transfer of heat, and water cooled compressors makes possible a more rapid transfer. Cooler cylinders assure better lubrication; cooler gas allows more gas to be compressed with each piston stroke. Particularly in large capacity installations, water cooling carries away heat rapidly and economically.



15 H. P. Shell and Tube Type Condensing Unit.



The Curtis Store and Office Cooler — 3 and 5-ton sizes.

This is only one of many engineering refinements offered by Curtis which contribute much to the high efficiency and dependable, trouble-free performance of Curtis condensing units.

It will pay you to find out more about Curtis. Write today.

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CURTIS REFRIGERATION AIR CONDITIONING AND COMMERCIAL

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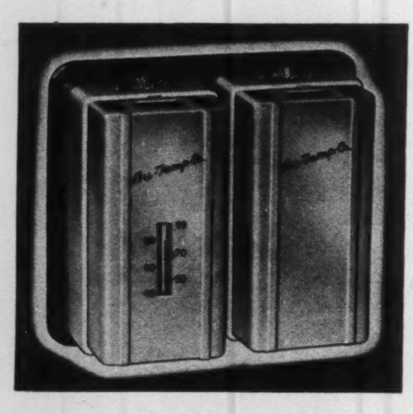
ONE OF A SERIES ON NEW AND IMPROVED AU-TEMP-CO CONTROLS

Precision Built for Precision Control!

Embodying important improvements in design and construction, the new series AU-TEMP-CO Motorized Control Valves are precision built for precision control of steam, air, gases and liquids.

Unit is most compact, has minimum moving parts, permits ample installation freedom in close quarters, and operates in any position required.

Valve motivated by AU-TEMP-CO's famous reversing motor which many years of field service have proved rugged and efficient. May be used with any three-wire controller. Over 50 types available to meet complete range of high and low pressure applications.



New Control Teamwork!

Startling in efficiency, design and simplified construction, here's the new AU-TEMP-CO tandem thermostat and humidistat assembly. Meets the demand of contractors and engineers, as well as owners, for a sturdily built, troubleproof unit which can be depended upon to provide precision control in a wide range of modern air conditioning, heating and processing applications.

Write for latest bulletins and control data.

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CORPORATION
ONE PARK AVE., NEW YORK, N.Y.

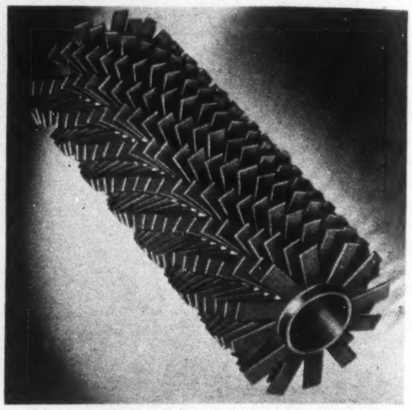
Automatic Controls and Systems for every heating, air conditioning and process control purpose.

A special formula is used in lining the pipe. A measured quantity of the mix is placed in the pipe and forced against the walls by a process which at the same time extracts a high percentage of the water in order to attain a lining with high physical properties. According to the maker, the lining is smooth so that pipe has a lower friction coefficient than the original pipe and yet is strong enough so that no special handling in the field is required to protect it.

The pipe is available in sizes of ½ to 12 in. inclusive, and 1 in. OD in special cases. Lined fittings for use with this pipe may be had.—Jones & Laughlin Steel Corp., Third and Ross St., Pittsburgh, Pa.

Extended Surface Tubing

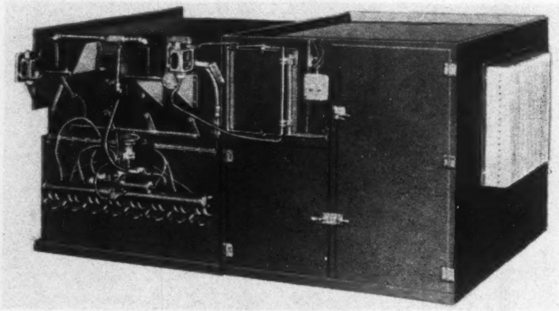
No. 1712**—The extended surface tubing illustrated has an inside diameter of 23/40 in. and an overall diameter of 1½ in. Both tube and fins are copper and the bond is obtained partially by the tension under which the fin is held while winding and partly by the sprayed metallic bond to which all exterior surfaces are subjected.



According to the manufacturer, a high Btu transfer with low resistance is obtained with this tubing and because of this a greater depth of massed tubes may be put in a coil to result in high Btu transfer per sq ft face area without increased pressure drop.—Tilco-Fin, Inc., 58 Second Ave., Brooklyn, N. Y.

Refrigeration Economizer Unit

No. 1713—An automatic unit called the "Refrig-O-miser" is offered for economy in power costs in refrigeration work where either pipe coils or unit coolers are used. The economy results from utilization of outdoor air by the unit during cold weather, and from the higher suction pressure produced by forced circulation under compressor operation. For new installations or where existing coils are to be replaced the unit is available with self-contained coils.



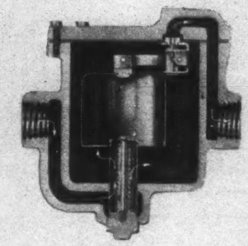
The unit stops the compressor and uses outdoor air as the cooling agent whenever it is lower in temperature than the desired indoor temperature. It functions automatically to raise the temperature of the outdoor air as may be necessary by mixing it with warmer inside air.—U. S. Air Conditioning Corp., 2101 Kennedy St., N. E. Minneapolis, Minn.

New Diaphragm Valves, Temperature Controllers

No. 1714—Among the new equipment developments recently announced are a line of diaphragm valves for controlling flow of destructive or hard-to-handle liquids and gases. Valves are of

FOR HARDEST SERVICE

SARCO INVERTED BUCKET STEAM TRAPS



In high speed production shops, where shut-downs cannot be tolerated, Sarco inverted bucket traps are favorites. They are built to withstand the shocks of "slam-bang" operation and violent load fluctuations as found, for example, in laundries and tailor shops.

They are unaffected by dirty steam and can be protected against the corrosive effects of boiler compound. Strainers built into every trap save installation cost.

This is only one of eight different types of steam traps in the Sarco line. Put your steam trapping and heating problems up to us. There is a competent representative near you.

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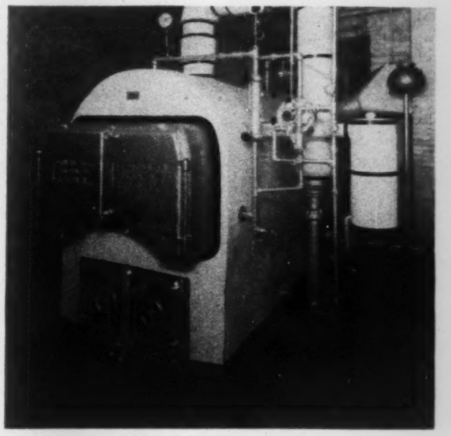

Hank Sez: — As How Out Of Sight Ain't Always Out Of Mind

The job to be done here, wuz ter heat a garage at Lancaster, Pa.
None of yer little corner fillin station affairs, but a grown up one, big enuff to wear long pants and have its own night key.

So a Burnham Welded Steel got the votes. Got 'em, not so much because the Burnham is so different in design, or has any gadgets other boilers haven't, but because being as how it's Burnham, there was a reputation, as well as a specification standing back of it.

But you ask, why in these days would anyone hand fire such a big boiler?
To which I'm replyin', "anyone" didn't.
It's stoker fired, with all the contrapshuns under the floor, out of sight, and out of mind.

After saying which, wanter add that we Burnham folks ain't hollaring louder fur a steel boiler than fur cast iron.
Ain't because we make both.
All we care about is your a gettin' whichever one best fits your needs and no room left ter rattle 'round in.

Hintful Hank

BURNHAM BOILER CORPORATION
Distributed Through Wholesalers
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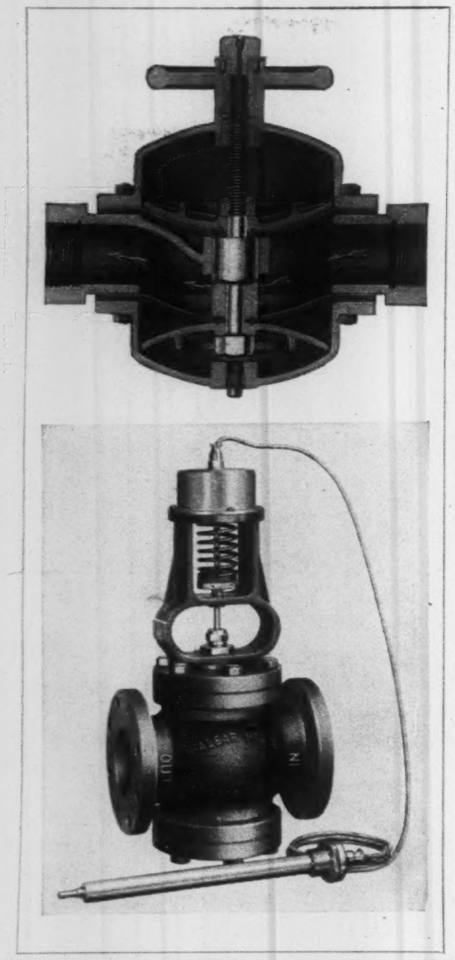
Branch Offices in all Principal Cities
Export Department, 50 Church St., N. Y. City

Burnham Boiler

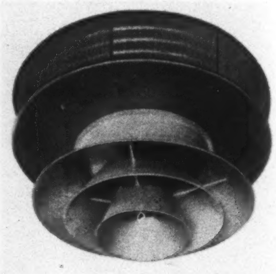
ferrous or non-ferrous construction, and are glass-, rubber- or lead-lined, according to the service for which they are specified. The valves operate in any position in the pipe line and are offered in the single and double diaphragm types with screwed ends in sizes 1 to 4 in., and with flanged ends in sizes 1 to 18 in.



The same manufacturer has also announced development of a self-operating temperature controller for direct control of liquid and gas temperatures and adapted to boiler feedwater heaters, hot water tanks, evaporators, chemical process temperatures, sterilizing processes and other applications. It is available for a wide variety of temperature applications from 75 to 260 F, 40 F stages; sizes run from 1½ to 4 in., with larger sizes special order.

Also announced by the same maker is a series of improve feedwater regulators for steam boilers (not shown).—McAle Mfg. Co., 1901-1909 S. Western Ave., Chicago, Ill.

Unit Heater with Air Diffuser



No. 1715—The "Projection" unit heater illustrated is no available with an "Anemostat" air diffuser (which was originall designed for duct applications), the aim being to provide a draftless and blastless air stream. Among the applications recommended by the maker are industrial plants and textile mills where low velocity, dustless air currents are essential.

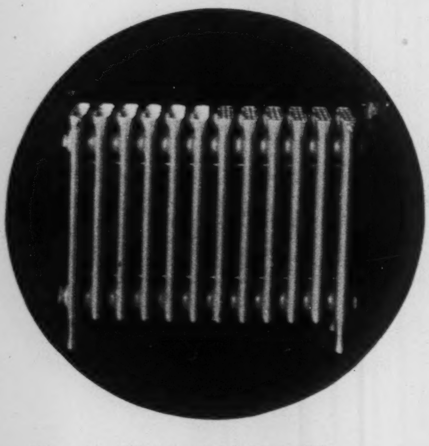
The same manufacturer has also announced a new evaporative cooler expressly designed to cool fluids in a closed system. Diesel engine cooling, cooling of dehumidifying liquids, cooling transformer oil and cooling quenching oil are among its applications. For the average application it is not advisable to attempt to cool beyond 90 deg due to the size of the unit required, the maker points out.—Trane Co., La Crosse, Wis.

Electric Unit Heater

No. 1716—These new "Type UB Chromalox" electric unit heaters are offered for heating offices, rooms in factories, etc., where positive air circulation is desired to eliminate cold spots. "Koilfin" strip heating units are mounted in the cylindrical housing and the blower motor is mounted in the center of the heating unit assembly, the motor being cooled by the fan. All connections

THE HUMID-HEET* RADIATOR

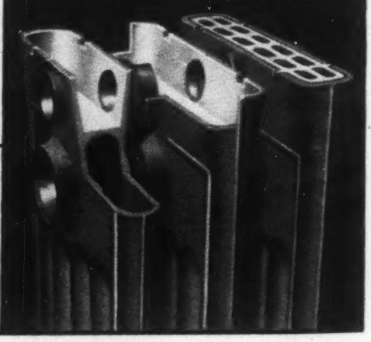
Humidifies While It Heats



Every man selling heating systems to home owners often wishes he had a "special"—something different—to give him an added sales advantage. The "Humid-Heet" humidifying radiator is exclusive—and offers a talking point that will help to clinch many a hesitant customer. As you know, humidification is one of the important features of winter air conditioning. The Humid-Heet Radiator offers simplified humidification at reasonable cost, and—this is important—there are no complicated motors or valves to make the installation difficult. It is practical and efficient, and does a thorough job of humidification.

SANITARY WATER WELLS

Easily cleaned, porcelain wells at the top of the radiator sections hold ample water for humidification. One or two Humid-Heet radiators will completely humidify the average home. The water supply is controlled by a simple, inexpensive valve attached to the radiator.



*Trade Mark Registered U. S. Patent Office
U. S. Patent Numbers—D86605, D91857, 2161834

UTICA RADIATOR CORPORATION

Boilers • Radiators • Convectors • Air Conditioners

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of

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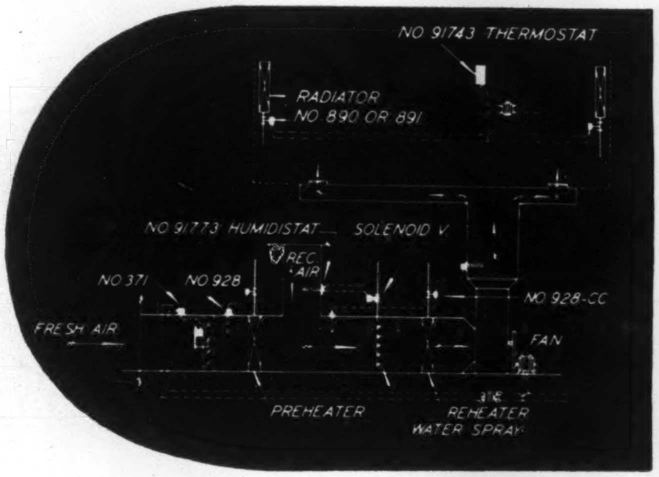

Illustrated above is a typical application of modern Sylphon Controls in "split system" heating, ventilating and humidifying.

Heating: The Sylphon modulating room thermostat controls electric valves on direct radiation.

Ventilating: The No. 371 Damper Motor keeps the fresh air damper open only while the fan motor is running. Discharge air temperature is controlled by the No. 928-CC Compensated Regulator in steam supply line to reheater.

The No. 928 Regulator opens steam supply to preheater when fresh air temperature goes below 35°F, to prevent freezing and supply auxiliary heat.

Humidifying: Water supply to sprays is controlled by a solenoid valve operated by a duct humidistat located in recirculated air duct.

Sylphon reduces complicated air conditioning control problems to simple solutions. Gives desired results at low cost. Assures dependable performance — long, trouble-free life.

Investigate. Ask for new Bulletin TE-820, which describes complete line.

"SYLPHON MEANS SIMPLICITY IN AIR CONDITIONING CONTROL"

FULTON
Sylphon
FOR
TEMPERATURE
CONTROL

THE FULTON SYLPHON CO.
KNOXVILLE, TENNESSEE
Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England

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Pillow Blocks by Randall for important industries

Randall Randall Universal Pillow Block—A heavy duty bearing designed for mounting in any position. It is self-aligning, self-lubricating and has two large oil reservoirs. It operates quietly with low coefficient of friction and minimum running torque. The bearing surface is precision machined or diamond bored.

Randall Randall Flange Pillow Block—Designed for side mounting only on such applications as unit heaters or cabinet type air conditioning equipment. It is of rugged construction and has the same double reservoir oil return ball as the Universal plus all other desirable features of that pillow block.

Write for catalog describing the complete line of Randall pillow blocks.

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A-P Valves are supersensitive, leakproof, simple in construction and operation — precision built to give you Dependable Performance that makes Refrigeration and Air Conditioning Service a pleasure. Ask your Jobber about them.

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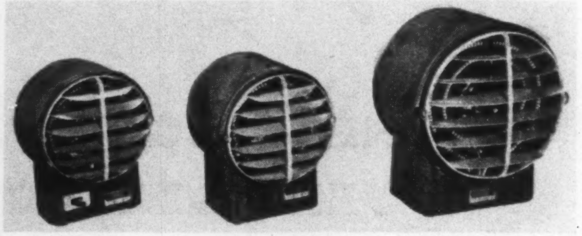
DEPENDABLE
THE BY-WORD FOR A-P VALVES

are made inside the base, which has a removable bottom cover louvers on the front of the heater can be tilted to direct the war air stream downwards.

The units are protected against overheating by a thermostati switch which opens the heating circuit if normal operating tem peratures are exceeded. The reset button inside of base i pushed in to close the heater circuit when normal temperatur is restored.



These units are available in eight sizes ranging from 2 to 1 kw.—Edwin L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh, Pa.

Booklets, Reports and Papers

Codes on Refrigerant Expansion Valves and Air Conditioning Units

The American Society of Refrigerating Engineers, 37 W. 39th St., New York, N. Y., has published two codes of importance to the refrigeration and air conditioning industries: Proposed Standard Methods of Rating and Testing Self-Contained Air Conditioning Units for Comfort Cooling (ASRE Circular No. 16), and Standard Method of Rating and Testing Refrigerant Expansion Valves (ASRE Circular No. 17).

The air conditioning unit code is a preliminary version which will later be revised and adopted in final form. It covers methods of rating and testing units, classifies various types, describes the method of rating, instruments, apparatus, cooling and heating capacity tests, humidifying tests, and gives definitions for establishing a standard terminology. The valve code is the final standard approved by the ASRE Council March 6. It contains approved methods of rating and testing thermostatic expansion and automatic expansion valves.

Copies of these codes are available from the ASRE for 20 cents each.

Book Reviews

Medical Climatology

["Medical Climatology," by Clarence A. Mills, Ph.D., M.D., Professor of Experimental Medicine, University of Cincinnati. 1st ed. 1939. 296+vii pp., 6 x 9 in., clothbound. Published by Charles C. Thomas, 220 E. Monroe St., Springfield, Ill. Price, $4.50.]

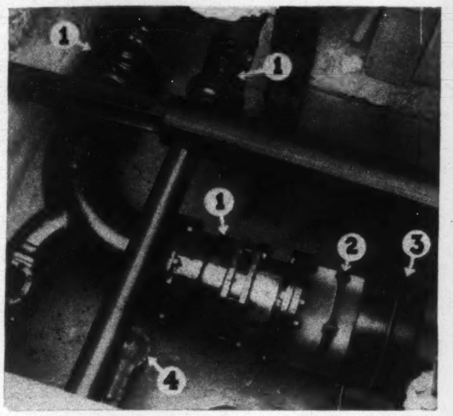
Although this book is written primarily for physicians who wish to know the effects of climatic environment in matters concerned with human health and disease, it is pertinent as well to air conditioning engineering. There is, in fact, a chapter on the conditioning of indoor environments and Dr. Mills points out that studies already carried on by the few working in this field have indicated the broad manner in which public health and welfare are involved in air conditioning. Biologic principles of great value to large masses of people are involved and the author believes it is imperative that those properly qualified waste no time in providing a scientific basis upon which engineers and the industry may build.

The chief problem in air conditioning is proper control of

ADSCO INTERNALLY GUIDED JOINT

A COMPACT, EASILY INSTALLED JOINT FOR HIGH OR LOW PRESSURES

A Typical Manhole Installation



(1) ADSCO Internally Guided Joints in manhole under construction (2) ADSCO Insulation Support (3) ADSCO Pipe Alignment Guide and (4) ADSCO Empire Steam Trap.

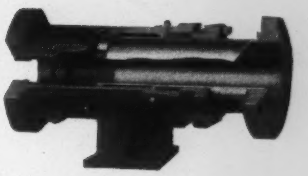
Can be specified with Confidence for years of Efficient Operation —Hundreds in Daily Use.

An internal guide on the inner end of the slip provides true axial movement throughout entire slip traverse. No metal to metal contact between polished slip surface and body. Slip cannot pull out of the joint. A compact joint for restricted space—largest diameter is the flange.

Available in single or double joints in semi-steel or cast steel for high pressures and high temperatures with flanged or beveled ends.

Write for Bulletin No. 35-30HP.

Sectional View of Joint



A Few Users

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Philadelphia Electric Co.
Philadelphia, Pa.
Atlanta University
Atlanta, Ga.
Moose Lake State Hospital
Moose Lake, Minn.
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Union Pacific R. R. Co.
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AMERICAN DISTRICT STEAM COMPANY

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MARINE DRIVE APTS
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The Marine Drive Apartments located on Chicago's Gold Coast is an eight story, fire proof building containing 202 apartments of four and five rooms. The heating system is a one pipe hot water system using 924 Streamaire convectors. The striking appearance, efficient operation and effective heating qualities of Young convectors are valuable assets to apartment operators and home owners in securing higher rents and lower heating costs.

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body heat loss, says the author. In the past, winter heating has absorbed most of man's attention as the centers of civilization and world power have shifted ever farther outward into the cooler climates of the temperate zones. As man has risen to power through the greater energy he derived through this cooler and more stormy climatic environment, his first necessity has been to avoid the benumbing and exhausting effects of winter cold. Now, however, when desirable cooler regions have been rather thoroughly exploited and settled, "man turns back toward the fertile areas of the tropics, and at once faces the debilitating effects of the moist heat that reigns there." In addition, says Dr. Mills, he is having his attention drawn to the need for protection against heat even in temperate regions because of the severe heat waves that are coming more frequently in summer as world temperature levels rise.

Dr. Mills has done considerable work in radiant conditioning and feels that this method has a number of advantages, which he discusses and outlines also in this chapter.

Dr. Mills' studies have indicated that people living in a climate where body heat loss can be readily accomplished "have a higher internal combustion level, grow more rapidly, mature earlier, reach a larger stature, are more resistant to infectious diseases and have a greater abundance of both physical and mental energy than do those living under conditions of moist warmth." With this push and vigor, however, goes a much greater rate of body breakdown from the more stressful existence—a higher incidence, and more severe and rapid course for various metabolic and degenerative diseases, together with more functional insanity and suicides. "Medical Climatology" discusses various phases of this energy basis of human existence, and the effect of climate on it, in detail.

Hot Water Heating

["Hot Water Heating by Forced Circulation in Theory and Practice," by Clifford H. McClain, Heating Engineer. 1st ed. 1939. 29 pp., 8¼ x 10¾ in., ring binding, cardboard cover. Photolithographed by Engineers Publishing Co., 401 N. Broad St., Philadelphia, Pa. Price, $2.00.]

The principles and methods set forth in this work have been drawn from many sources and it has been the author's object to present a composite picture of the most reliable material available at the present time. The facts and procedure are based on the research of several investigators and the author claims no originality for the material except in its form of presentation. He has, however, taken pains to make the interpretation and presentation both clear and accurate and includes necessary tables, graphs and other data, as well as examples and explanation of design procedures.

The first section of the book covers water and its properties, flow of water in gravity systems, flow of water in pipes, calculation of friction in pipes, and loss of head in fittings and particularly tees. The second part is devoted to practical applications and includes information on design procedure, design of radiator circuits, sub-mains and branches, and the author's concluding comments.

Vapor Charts

["Vapor Charts and Special Tables for Turbine Calculations" by Frank O. Ellenwood, Professor of Heat-Power Engineering, Cornell University, and Charles O. Mackey, Professor of Heat-Power Engineering, Cornell University. 1st ed. 1939. 43 + iv pp., 8¼ x 10¾ in., clothbound. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price, $2.50.]

Not only do these vapor charts replace the original steam charts first published by Professor Ellenwood in 1914 with far more extensive ones for steam, but the book also includes charts that show the thermodynamic properties of water, ammonia, "Freon," and mixtures of air and water vapor. The book form of chart is used as experience has shown it to be desirable to have the charts divided into many parts of convenient size for

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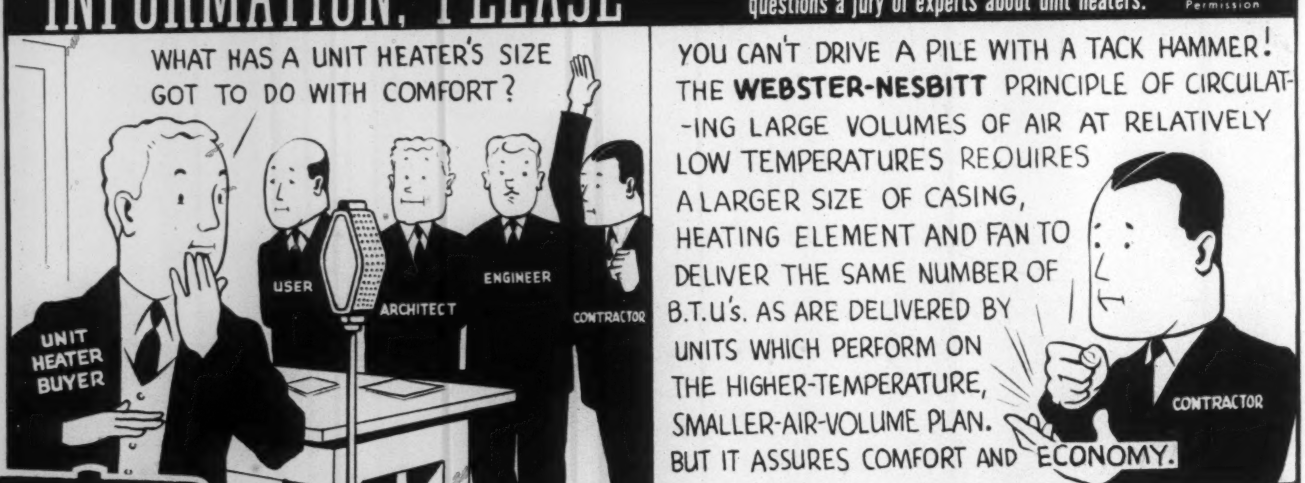
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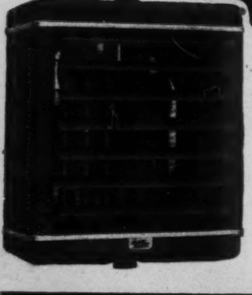

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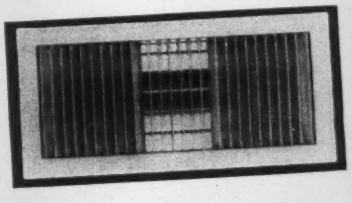

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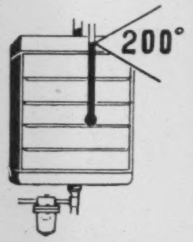
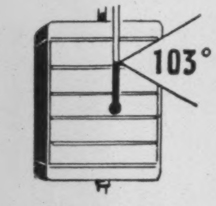


By actual test, using an Anderson Super-Silvertop trap the outlet air temperature reading was practically constant at 200°.



When using an inefficient steam trap the temperature reading varied from 103° to 144°.

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easy and accurate reading. The book also affords protection to the charts and permits quick reference.

The contents include a note regarding enthalpy, index chart for steam, steam charts, water charts, examples of the use of the charts, ammonia charts, "Freon-12" charts, psychrometric charts, and tables of corrections for barometric readings, jet velocity from ideal nozzle for each Btu and for each tenth of a Btu, and squares of numbers.

Steam and Hot Water Fitting

["Steam and Hot Water Fitting," by William T. Walters, Heating and Ventilating Engineer, Illinois Engineering Co. 1st ed. 1939. 184 + viii pp., 5½ x 8¼ in., clothbound. Published by American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price, $2.00.]

The author's object in writing this new book is to place before students, apprentices, steamfitters, draftsmen and designers the principles of good heating, and the following recommendations are given: Design the system according to good practice and use common sense; select the best equipment for the system and know what each part should do; and be sure it is installed correctly so that it will function at its maximum efficiency.

Chapters are given on boilers, steam radiators and coils, steam heating systems, vapor heating, vacuum systems, pumps, piping, fittings, valves, unit heaters, pipe fitting tools, greenhouse heating, hot water heating and panel heating, the last mentioned subject being touched upon only lightly but illustrating a recent installation.

Conventions and Expositions

Joint meeting, Fuels Division, American Society of Mechanical Engineers, and Coal Division, American Institute of Mining and Metallurgical Engineers: October 5-7, Deshler-Wallick Hotel, Columbus, Ohio. Chairman, R. A. Sherman, Battelle Memorial Institute, Columbus, Ohio. Papers to be given on coördination of fuel engineering, a proposed code for testing coal, and recent developments in equipment for burning anthracite coal.

Industrial Unit Heater Association: Fourth regular meeting, October 6, Chicago, Ill. Secretary-Treasurer, L. O. Monroe, 5-208 General Motors Bldg., Detroit, Mich.

American Gas Association: Annual convention, October 9-12, Hotel Pennsylvania, New York, N. Y. Headquarters Office, 420 Lexington Ave., New York, N. Y.

American Public Health Association: Annual meeting, October 17-20, Hotel William Penn, Pittsburgh, Pa. Headquarters office, 50 W. 50th St., New York, N. Y.

American Welding Society: Annual meeting, week of October 22, Stevens Hotel, Chicago, Ill. Headquarters office, 33 W. 39th St., New York, N. Y. Papers to be presented include Oxy-acetylene Welding of Red Brass Pipe, by A. N. Kugler; 90 Deg Welded Nozzles, Piping Calculations, Design and Fabrication, by F. C. Fantz and W. G. Hooper; Extensions of Fusion Welding in Special Pipe and Pipe Fitting Applications, by E. Hall Taylor; and Welding in the Manufacture of Valves for High Pressures and Temperatures, by W. F. Crawford.

National Metals Exposition: Week of October 22, International Amphitheater, Chicago, Ill.

American Society of Heating and Ventilating Engineers: First fall meeting, October 30-31, Atlanta Biltmore Hotel, Atlanta, Ga. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Symposium on Measurement and Control of Temperature: November 2-4, Pennsylvania Hotel, New York, N. Y. Under

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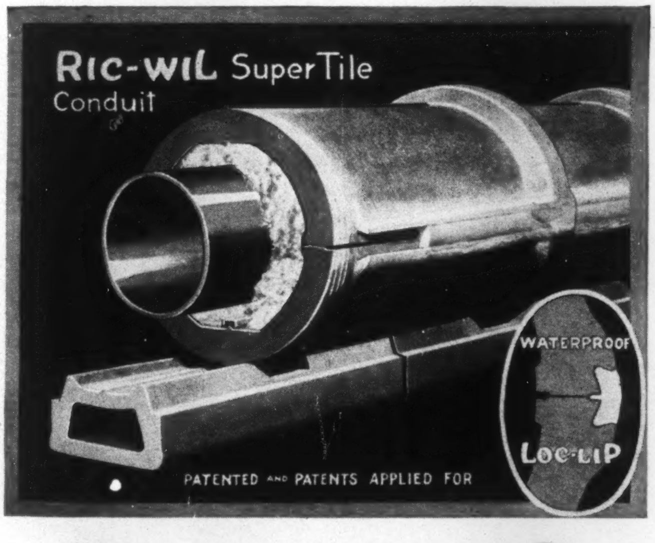

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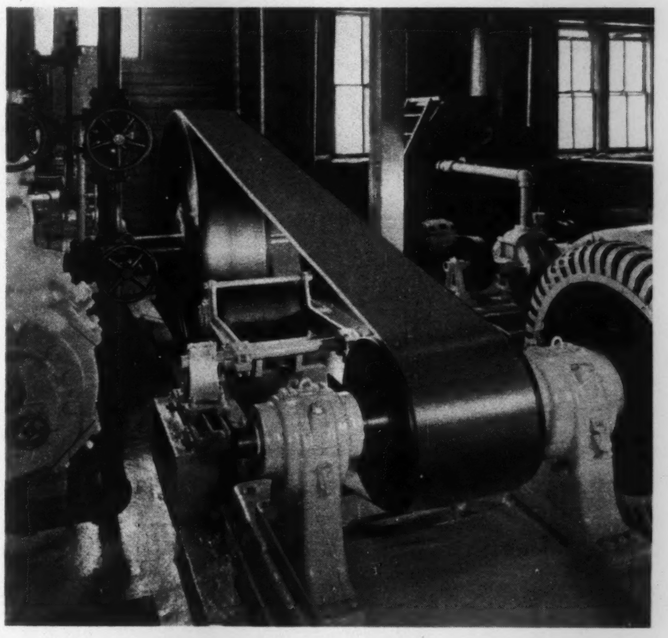

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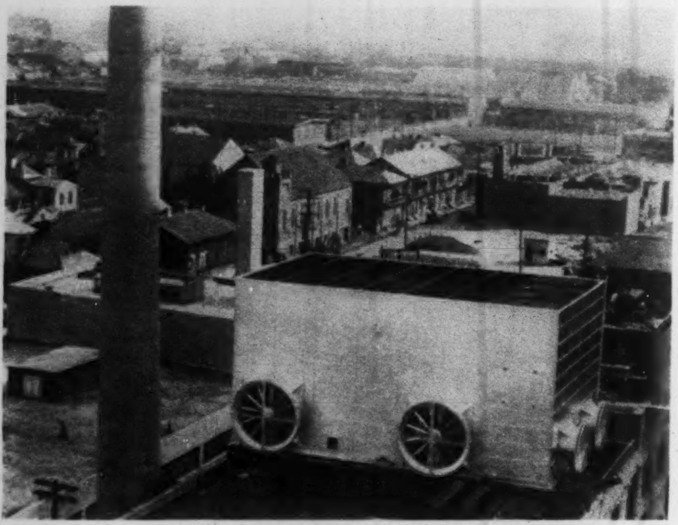

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Air Conditioning Conference: November 10-11, Lehigh University, Bethlehem, Pa., under sponsorship of American Society of Refrigerating Engineers. Includes sessions on industrial air conditioning; air conditioning of perishables; air conditioning of hospitals, apartments, and hotels; and air conditioning in transportation. Chairman, Prof. B. E. Jennings, Lehigh University, Bethlehem, Pa.

American Society of Mechanical Engineers: Annual meeting, December 4-8, Philadelphia, Pa. Headquarters office, 29 W. 39th St., New York, N. Y. To include discussion on heating and ventilating the modern airplane, a session on heat transfer, and a symposium on piping design.

Refrigeration Service Engineers Society: Annual convention January 15-18, Chicago, Ill. Secretary, H. T. McDermott, 433 N. Waller Ave., Chicago, Ill.

Refrigeration and Air Conditioning Exhibition: January 15-18, Stevens Hotel, Chicago, Ill. Exhibition manager, R. M. McClure, 111 W. Washington St., Chicago, Ill.

American Society of Refrigerating Engineers: Annual meeting, January 16-19, Blackstone Hotel, Chicago, Ill. Secretary, D. L. Fiske, 37 W. 39th St., New York, N. Y.

American Society of Heating and Ventilating Engineers: Annual meeting, January 22-26, 1940, Hotel Statler, Cleveland, Ohio. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Sixth International Heating and Ventilating Exposition: January 22-26, 1940, Lakeside Hall, Cleveland, Ohio. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

National Warm Air Heating and Air Conditioning Association: Annual convention, January 22-24, Hotel Hollenden, Cleveland, Ohio. Managing Director, Allen W. Williams, 5 E. Long St., Columbus, Ohio.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 126. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to Heating, Piping and Air Conditioning.

No. 3302. AIR CONDITIONING: Carrier Corp., 302 S. Geddes St., Syracuse, N. Y. Bulletin featuring air conditioning installations at New York World's Fair and throughout the world.

No. 3303. AIR CONDITIONING THEATERS: Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. Y. 12 p. bulletin illustrating theater air conditioning installations throughout the world, with brief descriptions and diagrams.

No. 3304. AIR ELIMINATORS: Gorton Heating Corp., Cranford, N. J. 4 p. bulletin (109) on system of vaporizing and equalizing steam heating systems for automatic heating.

No. 3305. AIR FILTERS: Carrier Corp., 302 S. Geddes St., Syracuse, N. Y. 8 p. bulletin on removal of pollen in rooms reporting results of tests with pollen filter in a room ventilator, by Prof. F. H. Hodgson of Roosevelt hospital.

No. 3306. AIR FILTER-SILENCERS: Air-Maze Corp., 5200 Harvard Ave., Cleveland, Ohio. 2 p. data sheet on oil bath filter-silencer units and "Unimaze" filter-silencer units for avoiding intake noises.

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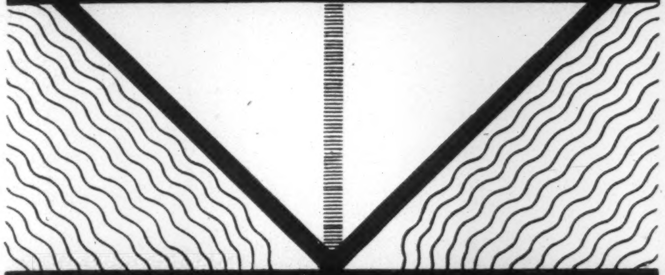

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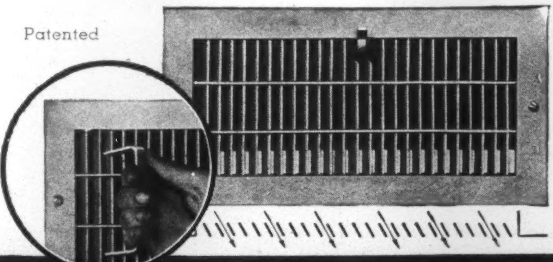

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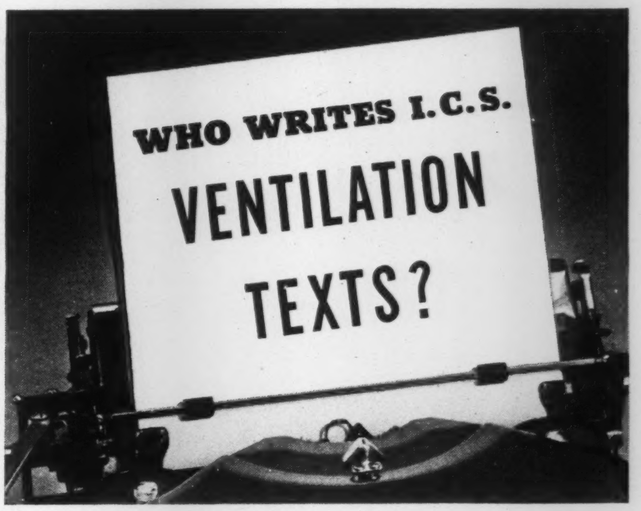

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No. 3307. BEARING LUBRICATION: U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles, Calif. 4 p. bulletin describing "Lubriflush" method of bearing lubrication for motors.

No. 3308. BOILER FEED WATER TREATMENT: Permutit Co., 330 W. 42nd St., New York, N. Y. 8 p. bulletin (2118) on "Zeo-Karb" method of water conditioning for boiler feed water and industrial applications. Also an 8 p. reprint on treatment of boiler feed water by this process, by Joseph D. Yoder.

No. 3309. BOILER ROOM AND PLANT INSTRUMENTS: Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., 4534 Wayne Ave., Philadelphia, Pa. 16 p. booklet (29-31) on boiler room instruments explaining how to prevent waste and describing instruments for steam generation, steam distribution, CO_2 meters, pyrometers, flow meters, water level meters, thermometers and pressure gages, and control valves for zone heating.

No. 3310. BOILERS: Kewanee Boiler Corp., Kewanee, Ill. 4 p. catalog (96) describing heavy duty riveted updraft firebox steel boilers for high pressure (100-125-150 lb), and a broadside on smokeless boilers featuring their steel riveted construction.

No. 3311. CEMENTS: Smooth-On Mfg. Co., 568-574 Communipaw Ave., Jersey City, N. J. 40 p. booklet on iron cements for stopping leaks, describing applications and methods of using with particular attention to piping and heating equipment.

No. 3312. CONDENSING UNITS: Carrier Corp., 302 S. Geddes St., Syracuse, N. Y. Two 4 p. bulletins, one on ¼ and ¾ hp air cooled condensing units, and the other on ½ and ¾ hp water cooled units.

No. 3313. CONTROLLERS: Foxboro Co., 106 Neponset Ave., Foxboro, Mass. 31 p. bulletin (184-3) describing "Rotax" controllers for applications where "open and shut" or two position control is desired.

No. 3314. CONVECTORS: Young Radiator Co., 709 Mead St., Racine, Wis. 24 p. catalog on convectors giving information concerning their use, installation drawings and capacity tables.

No. 3315. DRIVES AND MOTORS: Allis-Chalmers Mfg. Co., Milwaukee, Wis. 28 p. booklet (B-6029) containing data on "Texrope" drives and "Lo-Maintenance" motors to help specifiers and buyers in estimating costs, types and sizes of the drive equipment and motors under various operating conditions.

No. 3316. DUST ENGINEERING: American Air Filter Co., Inc., 107 Central Ave., Louisville, Ky. Issue of "Dust Engineering" dated August, 1939, describing various items of this manufacturer's equipment and illustrating uses.

No. 3317. EVAPORATORS: Young Radiator Co., 709 Mead St., Racine, Wis. 20 p. catalog of evaporator units for use with "Freon", methyl chloride or any common refrigerant.

No. 3318. GASKET MARKING TOOL: Crane Packing Co., 1801 Belle Plaine Ave., Chicago, Ill. Gasket tool for marking and outlining gasket sizes on sheet packing, designed to eliminate the need of using a pair of dividers and referring to gasket tables.

No. 3319. HYDRAULIC VALVES: Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa. 4 p. bulletin (H-209) giving data on "Yarway" hydraulic valves in single pressure and two pressure types.

No. 3320. INDIRECT AIR HEATERS: Despatch Oven Co., 600 Ninth St., S.E., Minneapolis, Minn. 8 p. bulletin giving

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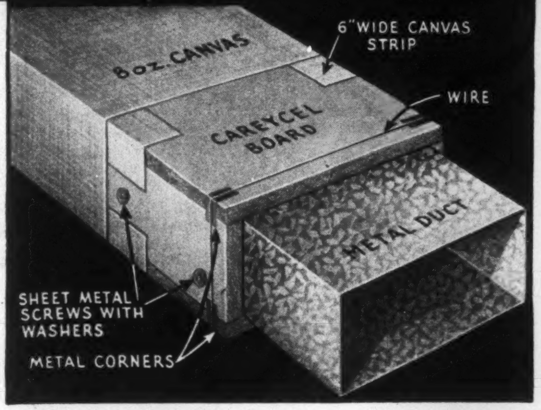

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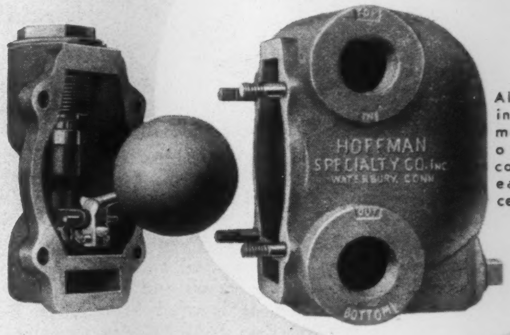
Anaconda Copper Pipe
Standard & Extra Heavy
•
Anaconda "67" Brass Pipe
Standard & Extra Heavy
Leading wholesale distributors stock the complete Anaconda line

3907

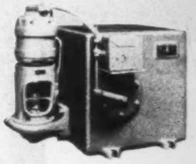
Anaconda Copper & Brass
The American Brass Co. • General Offices: Waterbury, Conn.
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.
Subsidiary of Anaconda Copper Mining Company

50 SERIES TRAP

NOW AVAILABLE FOR OPERATING PRESSURES UP TO 125 LBS. DIFFERENTIAL



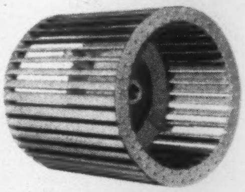
All working parts mounted on the cover for easy accessibility

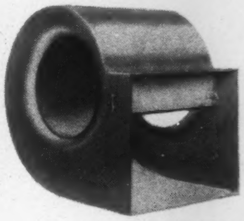


VALVES • • • TRAPS • • • PUMPS
A complete line of superior products at no greater cost . . . sold everywhere by leading Wholesalers of heating and plumbing equipment. Write for free catalogs.

HOFFMAN
SPECIALTY CO., INC.
WATERBURY, CONNECTICUT

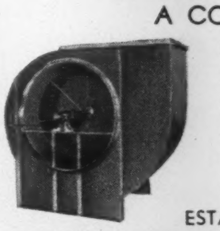
BLOWER — WHEELS
— HOUSINGS
— ASSEMBLIES





LOW HORSEPOWER
QUIET OPERATING
SINGLE and DOUBLE INLET
FOR
AIR CONDITIONING FURNACES
UNIT AIR CONDITIONERS
STOKER and OIL BURNERS
CIRCULATING UNITS
ATTIC VENTILATORS

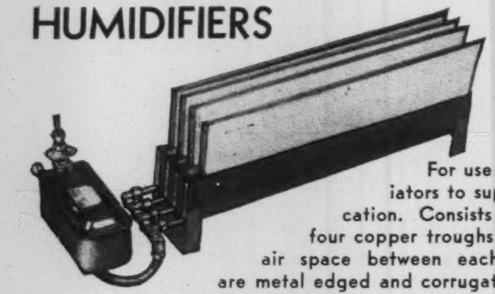
A COMPLETE LINE OF



SQUIRREL CAGE, PROPELLER AND STREAMLINE FANS
AIR CONDITIONING BLOWERS
AIR WASHERS—UNIT HEATERS
FURNACE BLOWERS AND STEAM SPECIALTIES.

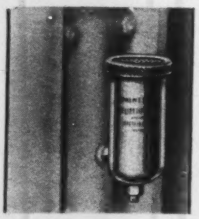
ESTABLISHED IN 1879
THE BISHOP & BABCOCK MFG. CO.
CLEVELAND, OHIO
REPRESENTATIVES IN PRINCIPAL CITIES

NEW PROFITS IN HUMIDIFIERS



The "Convector" Humidifier

For use with concealed radiators to supply ample humidification. Consists of series of two or four copper troughs 1/4" wide with a 1" air space between each. The evaporators are metal edged and corrugated with open space between walls to allow free travel of moisture to outside evaporating surfaces. Water is supplied automatically through an automatic float-controlled Water Feeder which is mounted on a nickel plated brass reservoir. Feeder is of Monel Metal, brass and copper nickel-plated. Water line can easily be raised or lowered to regulate humidity. Humidifier is available in eight sizes. The 18" four trough size will evaporate approximately 20 lbs. of water per day with radiator temperature of 130°. Other "Convector" Humidifiers are also made for warm air heating systems. For exposed radiation, specify No. 30 or No. 34.



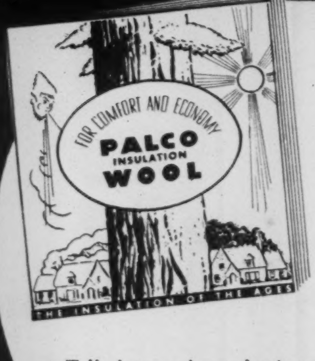
No. 95 Auto-Vent Humidifier

For steam radiators. Takes place of air valve. Automatically vents air from radiator and humidifies. Easily adjusted by set screw at bottom of valve. Specify V-95 for Vacuum Steam Radiators.

WRITE TODAY for Catalog H-10.

MAID-O'-MIST, Inc.
180 N. Wacker Drive, Chicago, Ill.

Fortify your Equipment *with* PALCO WOOL .255 B.t.u. EFFICIENCY



Write for this Free *NEW* 16-PAGE INSULATION MANUAL *NOW*

Tells how, why and where to use PALCO WOOL, durable Redwood bark insulation that provides PERMANENT THERMAL EFFICIENCY .255 B.t.u., (Peebles test) at lowest possible cost.

THE PACIFIC LUMBER COMPANY
100 Bush St., San Francisco
CHICAGO LOS ANGELES NEW YORK

data on gas and oil fired indirect air heaters, with ratings an dimensions.

No. 3321. INDUSTRIAL BUILDINGS: Austin Co., 1611 Euclid Ave., Cleveland, Ohio. 8 p. study giving a compariso of relative building and operating costs for single story an multi-story industrial buildings, including information on heating ventilating and air conditioning.

No. 3322. LINE SHAFT BOXES: Fafnir Bearing Co., 3 Booth St., New Britain, Conn. 8 p. bulletin describing ball bearing line shaft boxes, their features, and giving engineering details and specifications.

No. 3323. LOW WATER CUT-OFFS AND BOILER WATER FEEDERS: McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill. 4 p. condensed catalog and price list on low water cut-offs and combinations, feeders and feeder cut-off combinations, and conversion heads, including service recommendations.

No. 3324. NOZZLES: Spray Engineering Co., 114 Central St., Somerville, Mass. Looseleaf booklet on "Spraco" nozzles for industrial purposes describing uses and giving details on several types and their features.

No. 3325. OIL BURNING EQUIPMENT: Petroleum Heat & Power Co., 110 Davenport St., Stamford, Conn. 38 p. catalog of "Petro" oil burning equipment and oil burners with sections on industrial oil burners, automatic high pressure boilers, accessories and services, and domestic equipment.

No. 3326. PUMPS: Peerless Pump Div., Food Machinery Corp., 300 Walnut Rd., Massillon, Ohio. 60 p. catalog (127A) on oil or water lubricated pumps including turbine, propeller, "Hi-Lift" and mine pumps, and pressure systems, with a description of the manufacturer's testing laboratories, installations, and a 12 p. section of engineering data with tables, graphs, formulas, etc.

No. 3327. RADIATOR VALVES: Dole Valve Co., 1901-33 Carroll Ave., Chicago, Ill. 6 p. bulletin of list prices on "All Star" line of air valves, vent valves, vacuum valves, gages, etc.

No. 3328. REFRIGERATION COMPRESSORS: Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J. 6 p. bulletin (C1100-B5) on vertical duplex double acting refrigeration compressors with enclosed crankcases, illustrating construction features in detail and giving dimensions.

No. 3329. SHADE SCREENS: Ingersoll Steel & Disc Co., 310 S. Michigan Ave., Chicago, Ill. 12 p. bulletin announcing new "Koolshade" screens for windows, designed specifically to keep out the heat of the sun, with information on construction of the shade, data on solar radiation reaching windows, and test results on solar transmission through this screen.

No. 3330. SILENT CHAINS AND SPROCKETS: Whitney Chain & Mfg. Co., Bartholomew Ave., Hartford, Conn. 64 p. catalog (V-135) giving information for selection and design of silent chain drives, including engineering data, dimensions, horsepower ratings, sprocket data and illustrations of typical drives.

No. 3331. SOLENOIDS, COILS AND TRANSFORMERS: Dean W. Davis & Co., Inc., 549 Fulton St., Chicago, Ill. 8 p. catalog (10) on solenoids, coils and transformers with technical information and illustrations of many applications.

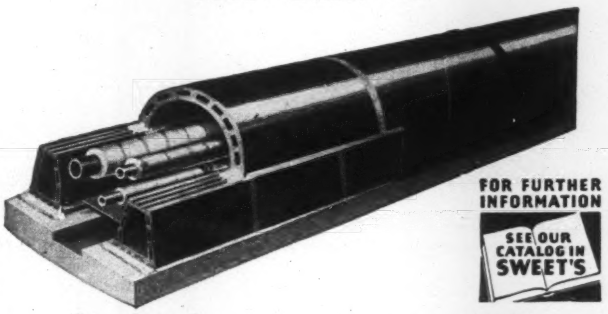
No. 3332. SOUND ABSORBING DUCT LINING: Johns-Manville, 22 E. 40th St., New York, N. Y. 4 p. folder (AC-23A) on "Airacoustic" sheets for control of noise transmission and fire in air conditioning ducts, including formula for determining amount of lining required for maximum sound absorption.

No. 3333. SPEED CHANGERS: Allis-Chalmers Mfg. Co., Milwaukee, Wis. 20 p. bulletin (B6013) on "Vari-Pitch" speed

THERM-O-TILE

The Conduit for Underground Steam Lines

Simplest
Strongest
Most Efficient



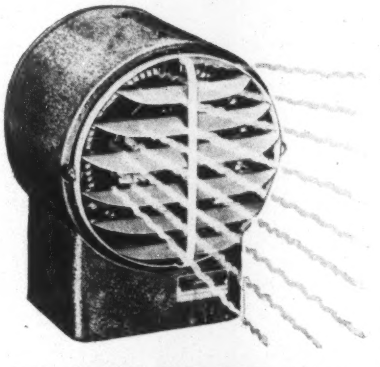
FOR FURTHER INFORMATION
SEE OUR CATALOG IN SWEET'S

Complete data and estimates on request.

Sold and Installed by Johns-Manville Construction Units in all Principal Cities.

H. W. PORTER & CO., INC.
825 FRELINGHUYSEN AVE., NEWARK, N. J.

ELECTRIC HEAT gives low-cost comfort in shop or office



CHROMALOX
ELECTRIC AIR HEATERS

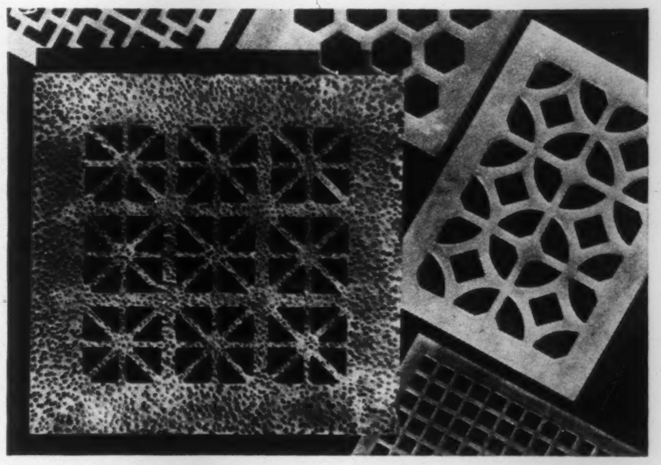
- Bring heat anywhere a BX cable can go—and that means *anywhere*.
- Quickly installed—no piping difficulties, no traps, valves, leakage troubles.
- Manual or thermostatic control, as desired.
- Adjustable vanes control direction of air flow.
- Sizes: 2 kw. to 15 kw. inclusive.

Why fire up the main heating plant for an occasional snappy morning, when these easily installed electric air heaters will give you almost instantaneous heat at the click of a switch, and shut off just as quickly, as the day warms up?

But that is only part of their value. When winter sets in, you have in Chromalox air heaters flexible auxiliary heating, driving warmed air into cold corners, providing heat for off hours, giving dependable stand-by heating service.

Built around the famous Chromalox electric heating units, used everywhere in various types for industrial heat. Full details in the Chromalox catalog — on request.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. **Pittsburgh, Pa.**



Wissco Grilles are made in various gauges of steel, brass, Wissco Bronze, monel and stainless steel and are available regularly up to 60″ x 156″ in all finishes.

WICKWIRE SPENCER STEEL COMPANY
500 Fifth Avenue, New York, N. Y.
Buffalo Worcester Chicago San Francisco

Send for WISSCO GRILLE catalog showing suggestions of attractive modern design made with Standard dies.

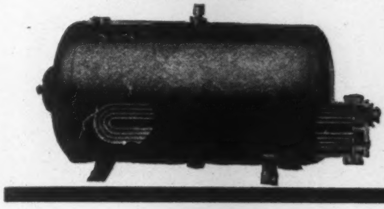
METAL GRILLES

WISSCO GRILLES

Patterson Hot Water Heaters in U.S. Housing Jobs

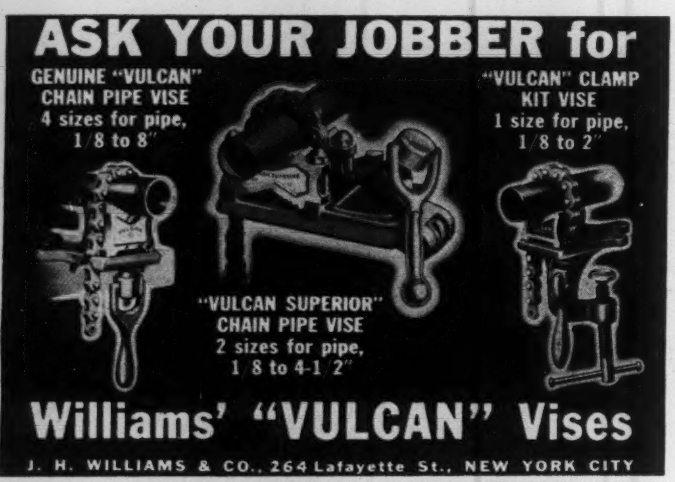
It is a gratifying tribute to Patterson Hot Water Heaters that they were chosen because of their durability and efficiency for the following great apartment houses.

Brewster Housing Project	Detroit
Laurel Homes Housing	Cincinnati
Cedar Central Housing	Cleveland
Community Housing	Indianapolis
Sumner Field Homes	Minneapolis
LaSalle Place Housing	Louisville
Ten Eyck Houses	New York
Harlem River Housing	New York
Williamsburg Houses Project	Brooklyn
Hillside Housing	New York
Knickerbocker Village	New York
Schonowee Village	Schenectady
Fairfield Court	Stamford
Outhwaite Housing	Cleveland
Old Harbor Housing	South Boston
Parklawn Housing	Milwaukee
Lauderdale Housing	Memphis



Send for our catalog

The Patterson-Kelley Co., Inc.
107 Warren St.,
East Stroudsburg, Pa.



ASK YOUR JOBBER for

GENUINE "VULCAN" CHAIN PIPE VISE
4 sizes for pipe, 1/8 to 8"

"VULCAN" CLAMP KIT VISE
1 size for pipe, 1/8 to 2"

"VULCAN SUPERIOR" CHAIN PIPE VISE
2 sizes for pipe, 1/8 to 4-1/2"

Williams' "VULCAN" Vises

J. H. WILLIAMS & CO., 264 Lafayette St., NEW YORK CITY

YARWAY INVOLUTE NOZZLES

The preference for trouble-free air washing service — because there are no internal parts or vanes to wear or clog. Proven through many years of service in water cooling and air conditioning installations totaling more than 5 million g. p. m.

Made in sizes and types for all requirements. Ask for Bulletin N-615.

YARNALL-WARING CO., PHILA.
107 MERMAID AVENUE

MEMO

FROM: Sales Manager
TO: Adv. Manager

Please make a note of the important message about January 1940 in the October issue of HEATING, PIPING and AIR CONDITIONING.

P. S. You'll find it on page 22.

FOR YOUR CONVENIENCE

HEATING, PIPING AND AIR CONDITIONING,
6 N. Michigan Ave., Chicago, Ill. [10-39]

Please ask the manufacturers to send me more informatio about the equipment mentioned under the following referenc numbers in "Equipment Developments" and "Recent Trad Literature." (Circle the numbers in which you are interested)

1708	1709	1710	1711	1712	1713	1714
1715	1716					
3302	3303	3304	3305	3306	3307	3308
3309	3310	3311	3312	3313	3314	3315
3316	3317	3318	3319	3320	3321	3322
3323	3324	3325	3326	3327	3328	3329
3330	3331	3332	3333	3334	3335	3336
3337	3338	3339	3340	3341	3342	

Name .... Title ....

Company ....

Address ....

City .... State ....

changer units for "keying production to profits," covering manual and electrical remote control units, dimension sheets, horsepower and speed range tables.

No. 3334. SPEED REDUCING MOTORS: Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill. Bulletin announcing new speed reducing motor for very low speeds at high torques; the motor itself develops from 1/50 to 1/20 hp depending upon the gear ratio used.

No. 3335. STOKER MOTORS: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 4 p. booklet (F-8489) on "Thermoguard" stoker motors which are said to be "self-protected against anything but fire or flood."

No. 3336. THERMOMETERS: H-B Instrument Co., Inc., 2518 N. Broad St., Philadelphia, Pa. 24 p. catalog (Blue Book Part 5) listing a full line of engraved stem laboratory thermometers and featuring new hydrometers.

No. 3337. TILE CONDUIT: American District Steam Co., Bryant St., North Tonawanda, N. Y. 12 p. bulletin (35-67B) on "Adsco-Bannon" tile conduit for underground steam or hot water lines, and including data on cast iron conduit for reinforcing steam lines under roadways and "Fiberglas" thermal insulation for underground lines.

No. 3338. VALVES: Crane Co., 836 S. Michigan Ave., Chicago, Ill. 4 p. circular (311) describing new line of 200 lb brass gate valves made with wedge disc, union bonnet, and rising stem, and available in integral seat and renewable seat types.

No. 3339. VENTILATING SETS: De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., East Moline, Ill. 24 p. catalog on volume and pressure type ventilating sets including more than 200 axial flow pressure fans ranging in size from 8 in. to 10 ft. Engineering and technical data are included, as are drawings and dimensions.

No. 3340. WATER COLUMNS AND GAGES: Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa. 20 p. bulletin (WG-1807) on water columns and gages with descriptions of features and construction details, and dimensions and prices.

No. 3341. WELDERS: Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis. 4 p. bulletin (W-26) describing design of new 200 amp P & H-Hansen welder.

No. 3342. WELDERS: Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio. 4 p. welder specification bulletin (334) on 200 amp belted or direct driven "Shield-Arc Junior" welders, and 4 p. bulletin (327A) on diesel engine driven 300 amp "Shield-Arc" welder.

STEEL
TRADE MARK
YOUNGSTOWN
PIPE
YOUNGSTOWN
YOUNGSTOWN

Clean Threads

Like an ocean tide, threads of Youngstown Pipe are strong and unvarying. Clean, strong, uniform threads are only one of many reasons why pipe users everywhere depend on Youngstown Pipe for ease of handling, low cost installation, long and troublefree life.

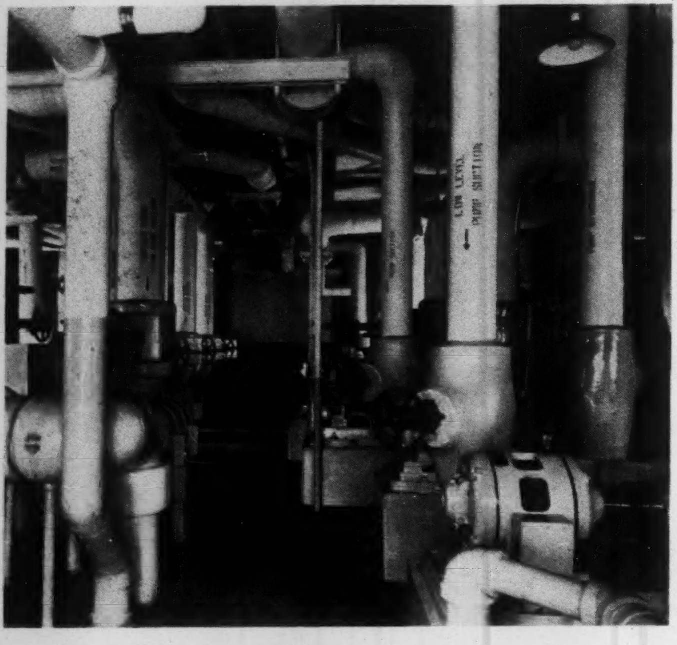
YOUNGSTOWN

THE YOUNGSTOWN SHEET
AND TUBE COMPANY
Manufacturers of Carbon and Alloy Steels
General Offices - YOUNGSTOWN, OHIO

Ask your distributor for Youngstown Pipe and Tubular Products - Tin Plate - Sheets - Plates - Conduit - Bars - Rods - Wire - Nails - Tie Plates and Spikes

19-5B

Pump room of the Italian Building, Rockefeller Center, New York, showing installation of Novoid Cork Covering. General contractor: Buensod-Stacey Air Conditioning, Inc., New York City. Insulation sub-contractor: Matthew Balich Corporation, New York City.



Novoid

AIDS AIR CONDITIONING IN ROCKEFELLER CENTER BUILDING

THESE air conditioning pipe lines in the Palazzo d'Italia, Rockefeller Center, New York, have the efficient protection of Novoid Cork Covering. Many of the large fittings and several of the lines containing welded fittings also are protected by cork. In addition, the water cooling tank is insulated with Novoid Corkboard.

Both Novoid Cork Covering and Novoid Corkboard play an important part in making air conditioning systems operate more efficiently and economically. Properly installed, Novoid Cork Insulation forms an effective barrier to the passage of heat, and prevents condensation. Find out how Novoid can help you increase the efficiency of your air conditioning system. For complete information, just mail the handy coupon below. Cork Import Corporation, 330 West 42nd Street, New York City.

NOVOID CORK INSULATION

Mail coupon for full details

Cork Import Corporation
330 West 42nd Street, New York City

Please send me complete details of Novoid Corkboard and Cork Pipe Covering for air conditioning systems.

Name ....

Street ....

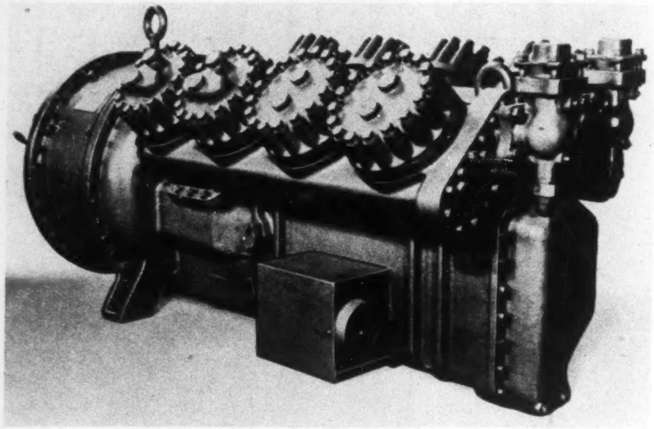
City .... State ....

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 135. Add the new products and companies listed here to your Directory Section which you received in your January, 1939, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Air Conditioning Compressors

No. 1717—Engineering features of the hermetically sealed V-type, 16 cylinder, 100 ton air conditioning compressor illustrated include no shaft seal, a refrigerant cooled motor, and a reversible oil pump. Starting is by line starter or reduced voltage and capacitors are added for high power factor applications. Of compact construction, the unit is 12 per cent more efficient than the manufacturer's previous totally enclosed designs, it is stated. The complete compressor occupies a 21 sq ft space and has an over-all height of 3 ft. If a water cooled condenser is necessary the entire unit can be built so that the floor space is not increased but the height required is increased to 6 ft. The complete compressor weighs 4200 lb net and with a water cooled condenser the weight is 8100 lb.



A reversible oil pump is used to protect the compressor. If the phase relationship of the wiring is changed anywhere in the electrical system, it will prevent the compressor being damaged because of oil pressure failure.

According to the manufacturer, the usual flexible connection and vibration eliminator are not used because precision methods of manufacture and assembly permit installation in almost any location with little worry about possible noise it might cause due to vibration of the building or connecting piping.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Direct Reading Air Meter; New Thermostat

No. 1718—A new instrument for the measurement of static pressure, air velocities and stack drafts directly from a pointed and graduated scale is called the "Airmeter" and has a pressure range of from 0 to 0.3 in. of water and a velocity range of from 300 to 2000 fpm. A unique feature is that the velocity scale is divided into four banks, each calibrated for a typical air temperature, and readings at other temperatures can be interpolated over the entire range. Overall dimensions of the protecting case are 8¼x4¼x5½ in. wide.

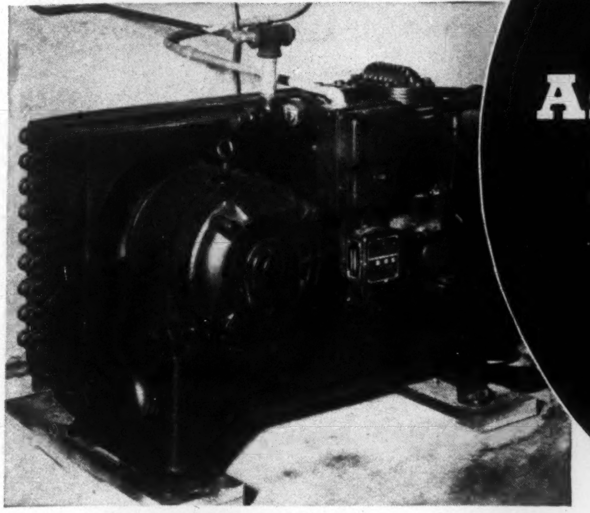
The same manufacturer has also recently announced a thermostat for low voltage control (25 volts, 2 amp maximum) of heating or cooling equipment. The ventilated case of this "Microstat" covers a switch mechanism suspended from a single point

Century Motor Specialization + Correctly Engineered Application = Specified Motor Performance

Century

Type RS MOTORS Assure Least Voltage Drop at Starting

—a real advantage for you and your customers . . .



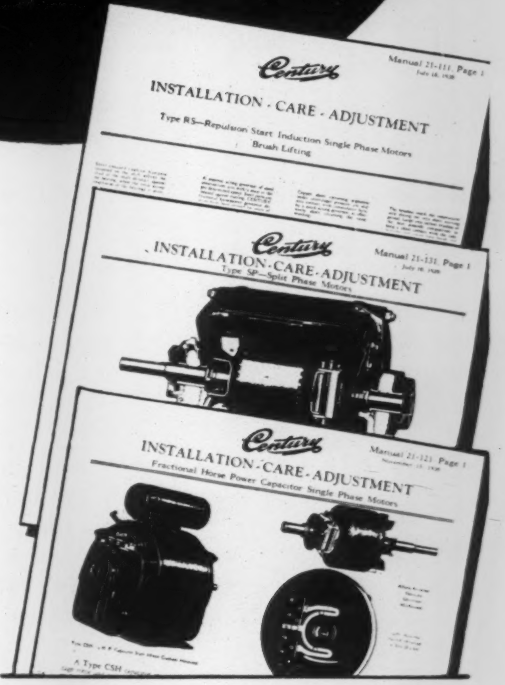
Century RS Single Phase Motor driving refrigeration compressor

THE high starting torque and low starting current of Repulsion Start Induction Single Phase Motors assure least voltage drop on long or heavily loaded lines, better voltage during starting at the motor terminals and least light flicker.

In addition, Century Type RS Motors provide smooth, quiet operation at all times, long life and an attractive exterior appearance that matches all requirements of modern equipment design.

Century Repulsion Start Induction Single Phase Motors have behind them *36 years of proven ability* to handle modern refrigeration compressors and other hard to start loads, requiring specified motor performance. There is a Century Type RS Motor engineered to meet *every air-conditioning requirement economically.*

Call in the Century Motor Specialist located nearest your office. His years of specialized experience in correct motor application are always at your service.



Century
Manual 21-111, Page 1
INSTALLATION · CARE · ADJUSTMENT
Type RS—Repulsion Start Induction Single Phase Motors
Brush Lifting

Century
Manual 21-131, Page 1
INSTALLATION · CARE · ADJUSTMENT
Type SP—Split Phase Motors

Century
Manual 21-121, Page 1
INSTALLATION · CARE · ADJUSTMENT
Fractional Horse Power Capacitor Single Phase Motors

A Type CSH

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If you have not received your copies of helpful, interesting FREE Bulletins on the Installation — Care — Adjustment of Century Motors write today. Ask for Bulletin A-10.

Century MOTORS

One of the Largest Exclusive Motor Manufacturers in the World

FOR SINGLE AND MULTIPLE PIPES
Ric-wiL
INSULATED
PIPE
UNITS
PATENTS APPLIED FOR

U. S. Patents 1,991,455 and 2,050,968. Canadian Patent 360,816.
Other Patents Pending.

RIC-WIL Insulated PIPE UNITS

PRE-SEALED UNITS for underground steam lines, in standard lengths, complete with steam pipes and all accessories.

ARMCO HEL-COR CONDUIT of heavy gauge pure ingot iron, with protective coatings to resist all forms of deterioration. Forty years of service are already pre-proved for you by Armco.

WATER-TIGHT, light in weight, yet amply strong to bear abnormal stress and strain, even in shallow trenches.

PIPE SUPPORT GUIDES are removable, give permanent pipe alignment, and seal ends of units.

INSULATION 85% asbestos with roofing jacket, or *any other* standard commercial insulation specified.

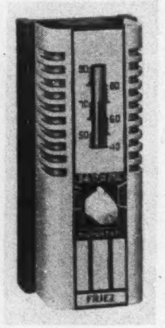
IMPORTANT!—while Ric-wiL Units have heavy protective coating of asphalt, they do not depend on this material (which is not strictly a solid, but has many of the characteristics of a liquid under all conditions) for their structural strength. Ric-wiL Units are a correctly engineered, solidly built system, mechanically sound, insuring a rigid, durable job *when* it goes into the ground and *after* it gets into the ground. Ric-wiL Units stand the load *inside* and *outside*.

Complete descriptive bulletin on request.

The Ric-wiL Co., Union Commerce Bldg., Cleveland, O.
New York San Francisco Chicago
Agents in principal cities

REGISTERED IN U. S. PATENT OFFICE
·RIC-WIL·
CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

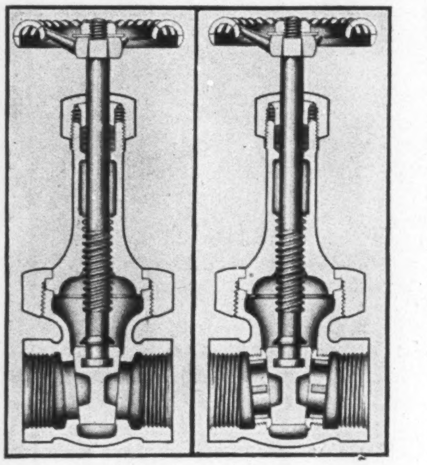
and featuring "Alnico" magnets, heat treated bimetals, and gold contacts. —Julien P. Friez & Sons, 4 No. Central Ave., Baltimore, Md.



AIRMETER
FRIEZ

200 Lb Brass Gate Valves

No. 1719—A new line of brass gate valves is made with wedge disc, union bonnet and rising stem, and is available in types with seats cast integral with the body and with renewable body seat rings. Discs and body seat rings are made of nickel alloy.



The valves are recommended by the maker for steam, water, oil or gas lines and are available in ¼, ⅜, ½, ¾, 1, 1¼, 1½, 2, 2½ and 3 in. sizes.—Crane Co., 836 S. Michigan Ave., Chicago, Ill.

Underwriters Approve Air Filter

No. 1720—Industrial and "Kleenflo" panel filters for air conditioning applications have been approved by the Underwriters' Laboratories, Inc., and when coated with the adhesive supplied by the manufacturer are recommended as "Class 2" filters, which are those which when clean burn moderately when attacked by flame, or emit moderate amounts of smoke, or both.

The "Kleenflo" filters are of patented construction consisting of a maze of crimped galvanized wire screens arranged to create graduated and progressive density and to embody the baffle impingement principle of air filtration. The filter element is held in a finished steel frame.—Air-Maze Corp., 5200 Harvard Ave., Cleveland, Ohio.

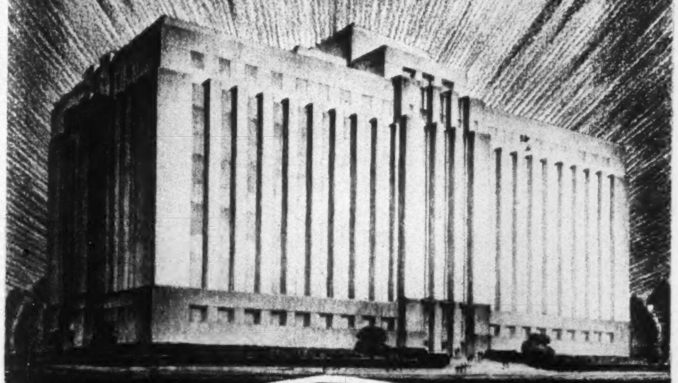
Additional Unit Heater Model

No. 1721—An additional model having 75 EDR capacity has been added to the maker's "Series 4" line of unit heaters, it has been announced. The addition of this model gives a complete line of 25 closely graduated sizes with 50 and 100 sq ft EDR between various sizes in order to provide a size to fit the wide range of load conditions encountered in the many commercial and industrial applications.—Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y.

Unit Heater and Temperature Controls

No. 1722—Illustrated is one of a new line of temperature and limit controls for unit heaters, a two wire line voltage thermostat

Bankers Life Bldg., Des Moines, to have



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Refrigeration for Air Conditioning

Using three big Frick Machines, totaling 650 tons capacity—a cooling effect equal to using 1,300,000 pounds of ice a day.

The air conditioning system, designed by Charles S. Leopold, includes radiant heating and cooling by pipes within the outside walls.

Tinsley, McBroom & Higgins, Architects: Pennsylvania Engineering Company, Contractors.

Join the thousands who benefit by Frick Refrigeration and Air Conditioning; it will increase your earnings. Get figures now: write to

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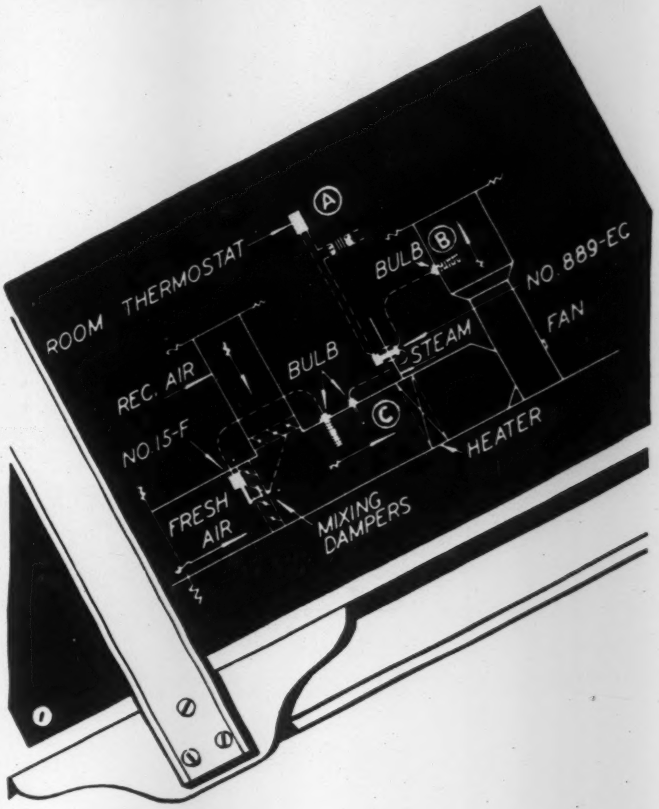
FRICK Co.

WAYNESBORO, PENNA. U.S.A.

One Instrument

that is practically a "WHOLE CONTROL SYSTEM"



The Sylphon No. 889-EC is a *modulating,* dual function regulator, ideal for control of duct heating and ventilating systems. It offers both room temperature and compensated minimum discharge air temperature control preventing cold drafts.

One typical arrangement of this instrument in duct heating and ventilating is illustrated above.

This regulator has two independent valves in a single body. Room temperature is controlled by thermostat "A" operating the electric end of the No. 889-EC Regulator in the steam supply line to the heater. Adjustable duct thermostat "B" acts as a low limit ductstat controlling the second valve to maintain desired minimum discharge air temperature. Thermostat "B" is compensated by Bulb "C", exposed to the mixed air entering the heater.

A Sylphon No. 15-F Damper Motor also controls the mixing dampers to prevent heater freezing.

Are you familiar with the present complete line of simple, rugged, dependable Sylphon instruments for all phases of air conditioning control?

Write for Bulletin VE-820. Sent on request.

"SYLPHON MEANS SIMPLICITY IN AIR CONDITIONING CONTROL"

FULTON *Sylphon* FOR TEMPERATURE CONTROL

THE FULTON SYLPHON CO.

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Built to Take it—and Say Nothing!—these HOWELL Air Conditioning MOTORS

Here are Three of the Many SAFEGUARDS which assure *Smooth, Quiet Performance*

An ad five times this size wouldn't adequately "cover" all SAFEGUARDS taken in **precision building and precision testing** HOWELL Air Conditioning Motors. But these three SAFEGUARDS are significant.

1. Improved Coil Varnish: Stator windings are thoroughly impregnated with HOWELL-BOND Insulating Varnish—toughest, most durable protection known. HOWELL-BOND is water, oil and grease-proof. **To make sure, windings are dipped and baked twice.**

2. Precision Balance: Every HOWELL Motor is given an ACCURATE vibrometer test with motor resting on 1-inch live rubber pad and operating at FULL speed. This close-limit check-up (more exacting than customary practice) assures PERFECT balance of rotor assembly and bearings.

3. Quietness Test is made in sound-proof laboratory with motor operating at FULL speed. A test which certifies that HOWELL Motors meet the most EXACTING requirements from the stand point of silent performance.

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Write for Bulletin SC-30, and see for yourself why HOWELL Motors out-perform and out-last other types.

HOWELL ELECTRIC MOTORS COMPANY
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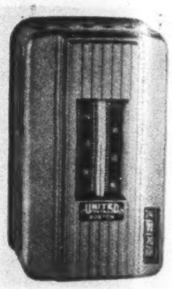
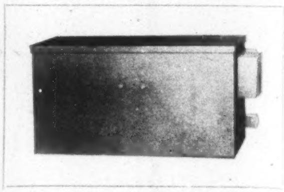


which may also be used for motor or solenoid steam valves. The control can be wall mounted or suspended on a length of conduit under the unit heater, and is equipped with a 2 in. junction box for either mounting. A sensitive thermal element exerting hydraulic force actuates a snap acting, fully enclosed, silver contact "Micro Switch." The device has a tamper proof, cast aluminum protection cover with "Allen" screws. Adjustment, which can be locked, is made with a screw driver without removing the cover. The temperature range is 56 to 84 deg, the differential being 2 deg.

Other controls in the line include strap-on and immersion waterstats, pressure vapor controls, and electric thermostats for industrial uses for temperatures from —50 to +600 F.—United Electric Controls Co., 69 A St., Boston, Mass.

Summer-Winter Controller; Static Pressure Regulator

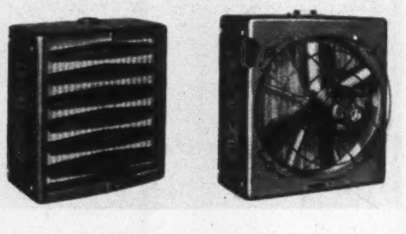
No. 1723—A new summer-winter controller for boilers has been developed for automatic control of the operation of both the summer and winter cycles. It is permanently adjusted by the installer to maintain minimum boiler temperature necessary to provide domestic hot water supply. The high limit aquastat is also permanently set by the installer and functions only as a safety control or high temperature cut-out. During the summer the burner is operated by the controller, but any time the room thermostat calls for heat, the boiler temperature is increased just sufficiently to take care of the heating load.



The same manufacturer has also announced a new electric static pressure regulator to control the static pressure in the discharge duct of a fan system, the overfire draft in a combustion chamber, or for similar applications where definite static pressure conditions are to be maintained. The positive pressure range is 0 to ¾ in. water column and the negative pressure range 0 to 1 in. water column. The minimum differential is 0.02 in. and the maximum 0.60 in. The electrical rating is 1 amp at 25 volts, ¼ amp at 110 volts, ⅛ amp at 220 volts a-c.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn.

Improved Unit Heaters

No. 1724—Improvements offered in a new line of unit heaters—the first the manufacturer has announced in six years—include sound silencing, a safety fan guard built into the unit, rust protection by the "Bonderizing" process, and a new streamlined appearance.



For sound silencing the casing is lined with an acoustical mastic to deaden noise, a velocity generator or stationary fan evens air flow through the condenser to eliminate air rush noises, a venturi fan shroud reduces air inrush noises, concentric rings of the safety fan guard dissipate vibration, and the motor is resiliently mounted in rubber on the fan guard.—Modine Mfg. Co., 17th St., Racine, Wis.

THE HUMID-HEET* RADIATOR

Humidifies while it heats

Here is a radiator that combines all the well-known features of even, radiant heat plus the advantages of healthful humidification.

Contractors today know that air conditioning is an attractive sales argument and that humidity is one of its important features. You will find that it is surprisingly easy to interest old customers as well as new ones in this simple and safe method of providing Humidification. You can create a profitable business by selling healthful humidity with Humid-Heet Radiators.

We have prepared a folder "Simplified Humidification for Radiator Heated Homes" which fully describes the Humid-Heet radiator. Write today for your copy and see how you can profit by selling this radiator to your air conditioning-minded prospects.

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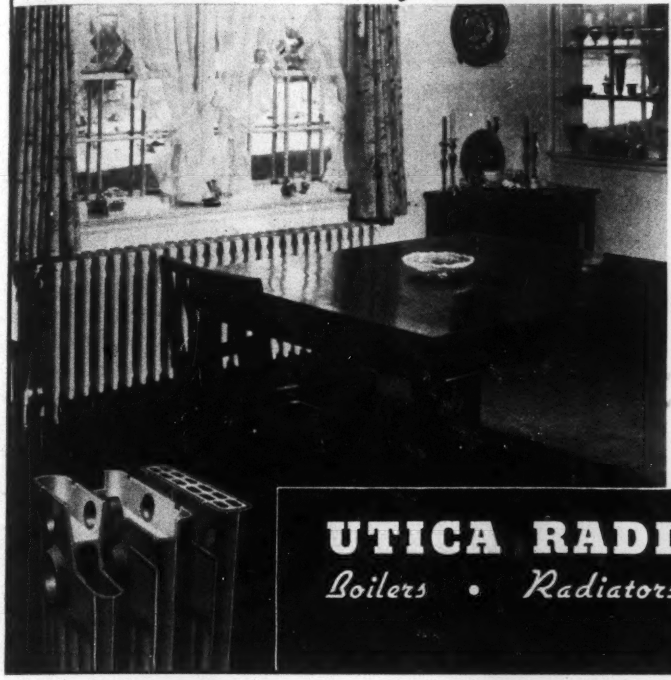

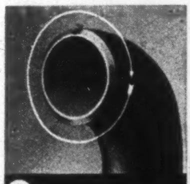

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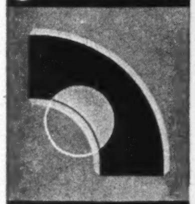

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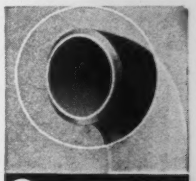

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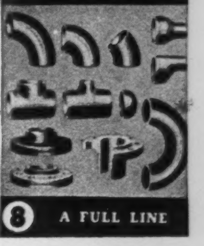
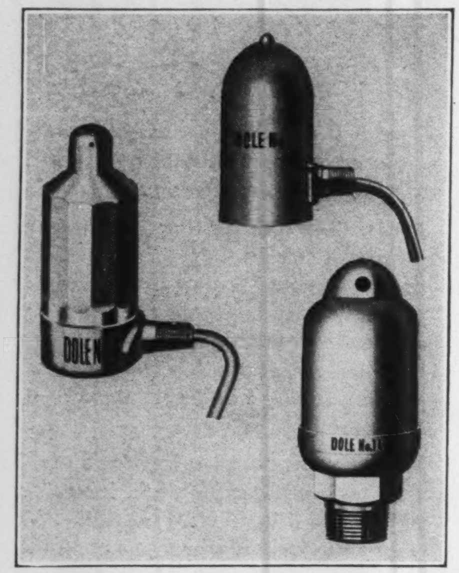


⑧ A FULL LINE

Redesigned Valve Line

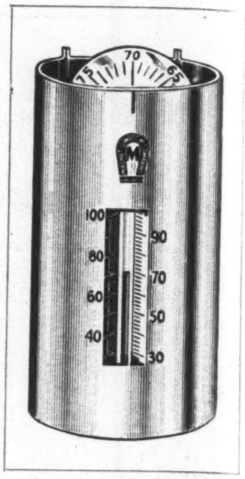
No. 1725—The "all-star" valve line has been re-engineered to provide for each type of installation the most suitable means of venting radiators, convectors, mains, pipe coils, etc., the maker states. The objective of the study was not to cut down the line but to survey the variety of modern applications and produce such valves as would be necessary to cover all needs.


DOLE No
DOLE N
DOLE No. 1

Fourteen valves and a special balancer for automatically fired vacuum systems are offered to cover the range of conditions. According to the maker, practically every valve in the line has been improved and most of them were completely redesigned inside and streamlined outside.—Dole Valve Co., 1901 Carroll Ave., Chicago, Ill.

Room Thermostat

No. 1726**—The new "Magnet" thermostat is open and well ventilated, according to the manufacturer, with the entire area of the thermostatic bar freely exposed in the air passage. Weighing 1¾ oz, the device responds quickly, says the maker, and will "float" with changes in room temperature. Light weight has been accomplished through simplification of design and the use of hard aluminum alloys for the entire structure, including the cover.


75
70
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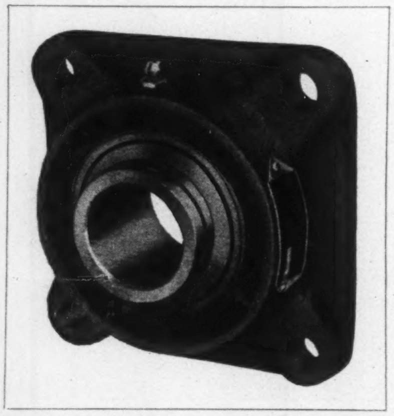
30

This thermostat is built for low voltage and the normal range is 60 to 80 F with a 2 F differential.—Magnet Switch Co., 356 W. Huron St., Chicago, Ill.

Flange Bearing Units

No. 1727**—New self-contained flange and take-up "Sealmaster" bearing units are offered in addition to ball bearing pillow blocks. The flange units consist of standard duty ball bearings mounted in a rigid one-piece housing, the bearings being self-contained and of the same specifications as the maker's standard duty cartridges used in pillow blocks.



These flange units and the take-up units are available for shaft sizes from ⅞ to 2-7/16 in. The take-up units are designed for mounting between guides for use in adjusting shafts and tightening belt bearings.—Stephens-Adamson Mfg. Co., 272 Ridgeway Ave., Aurora, Ill.

"INFORMATION, PLEASE"

A typical unit heater buyer, having heard a Canada Dry program, questions a jury of experts about unit heaters.

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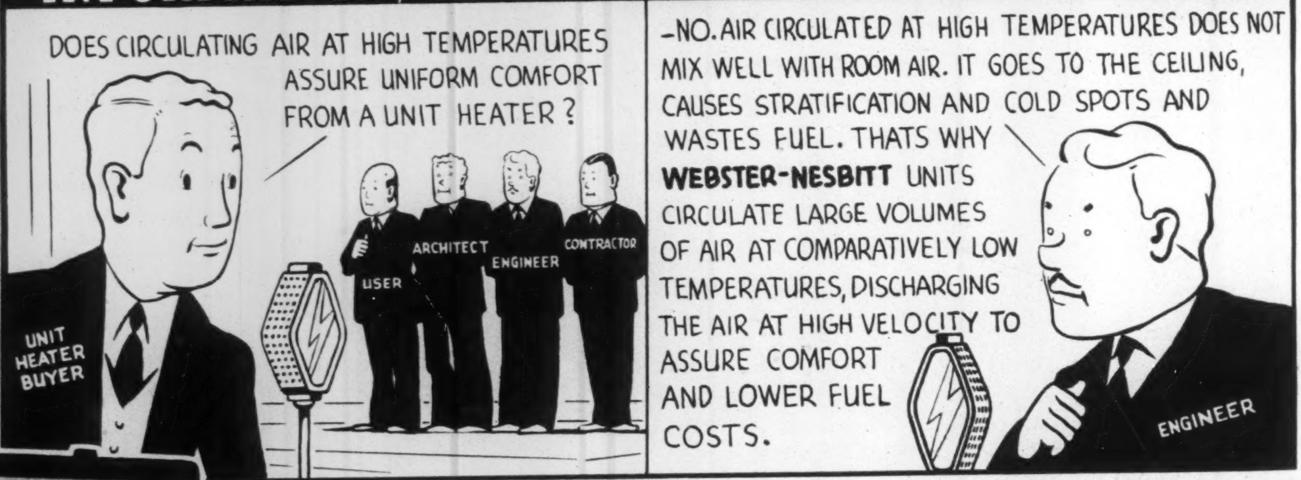
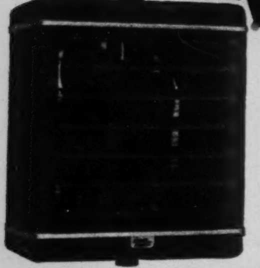

DOES CIRCULATING AIR AT HIGH TEMPERATURES ASSURE UNIFORM COMFORT FROM A UNIT HEATER?
UNIT HEATER BUYER
USER
ARCHITECT
ENGINEER
CONTRACTOR
-NO. AIR CIRCULATED AT HIGH TEMPERATURES DOES NOT MIX WELL WITH ROOM AIR. IT GOES TO THE CEILING, CAUSES STRATIFICATION AND COLD SPOTS AND WASTES FUEL. THATS WHY WEBSTER-NESBITT UNITS CIRCULATE LARGE VOLUMES OF AIR AT COMPARATIVELY LOW TEMPERATURES, DISCHARGING THE AIR AT HIGH VELOCITY TO ASSURE COMFORT AND LOWER FUEL COSTS.
ENGINEER



WEBSTER-NESBITT, quiet, propeller-fan unit heaters are recommended for heating small and medium-size interiors. Available in 7 casing sizes, each with a choice of 3 heating elements of varying capacities • Centrifugal-fan Giant unit heaters for heating large areas are offered in a full range of sizes and capacities • Series F unit heaters are for small interiors where exceptional quiet and neat appearance are important. In 4 sizes. **CATALOGS FREE ON REQUEST.**

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Announcing FAIRBANKS *NEW BRONZE GATE VALVES*

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FAIRBANKS

This new line of Bronze Gate Valves is a triumph of Fairbanks' half-century experience in research and engineering. Quality and craftsmanship stand out in every major and minor detail.

The new designing of parts and the more rugged construction assure easier operation, longer life and lower maintenance cost.

Here are some of the features of these new valves:

The large Bonnet Hex projects over the bonnet threads and provides more strength, greater wrench surface, easier dismantling and less breakage. Larger, stronger Pipe End Hexes provide a better wrench grip and prevent distortion.

The heavy bronze body is reinforced with Ribs at the sides and bottom, giving additional strength for withstanding pipe strain.

Large clearance between end of threads and diaphragm prevents long threaded pipe from damaging seats. Greater length of threads assure tighter, stronger pipe joints.

All Wedges are reversible. Rib guides in body assure perfect alignment and seating. Heavy internal ribbing of wedge prevents distortion when valve is subjected to sudden shock.

Non-rising stem valves are furnished with Solid Tapered Wedge having a full thread engagement with stem when closed. The rising stem type is regularly equipped with a Slip-on Solid Tapered Wedge. Split Wedge of ball and socket design can be furnished when desired.

Made in sizes from 1/4" to 3" for 125 lbs. pressure. Sold by distributors everywhere.

Write for our new booklet describing detailed construction of these valves.

THE FAIRBANKS COMPANY
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Factories: Binghamton, N. Y., Rome, Ga.

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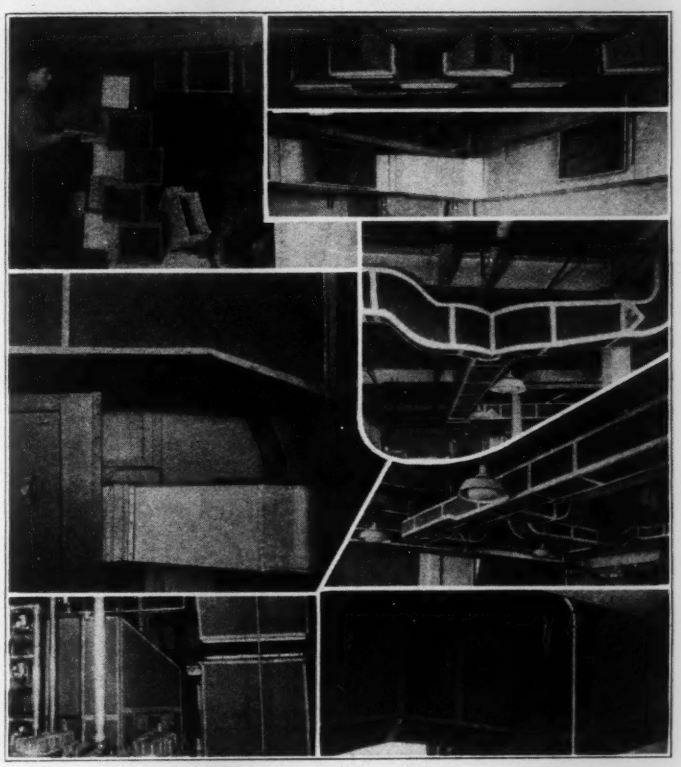

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1. Costs Less
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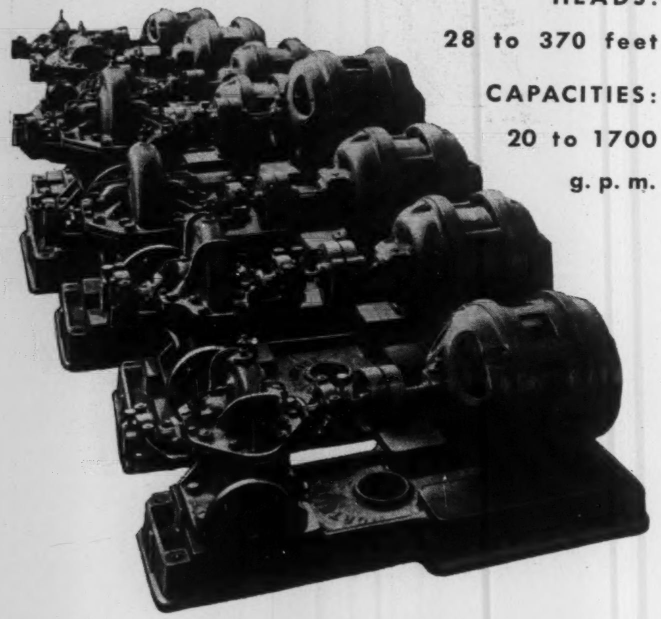

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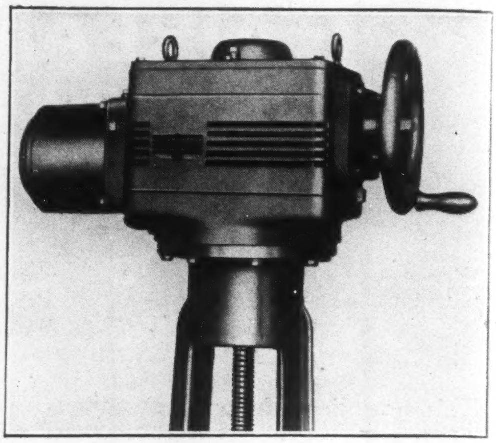
WORTHINGTON PUMP AND MACHINERY CORPORATION

Valve Operating Unit

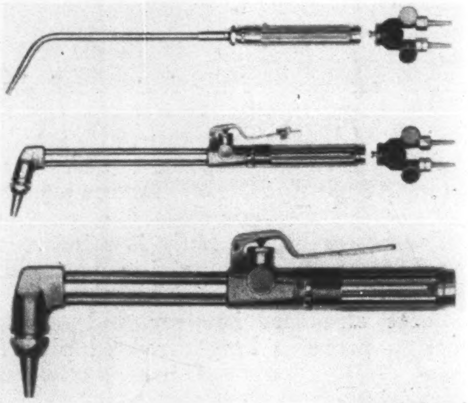
No. 1728*—A new valve operating unit for use in oil, air, gas, steam and other lines is intended for electric motor operation of gate and globe valves or sluice gates. It provides a controlled thrust action directly on the valve stem, the maker states, and the dust tight, weather-proof unit is bolted on top of the valve yoke.



It comprises essentially thrust springs to compensate for expansion and contraction of the valve stem; a high torque reversible motor; a jaw clutch for coupling the operator to the yoke nut; an oil immersed gear reduction; thrust limit switch controls; a position limit switch to stop the operator in an open valve position; and a handwheel for manual operation which is normally disengaged and does not turn during motor operation.—Cutler-Hammer, Inc., N. 12th St. & W. St. Paul Ave., Milwaukee, Wis.

Welding and Cutting Equipment

No. 1729—Several improvements are featured in a new line of "Prest-O-Weld" welding and cutting apparatus, which consists of a welding blowpipe, cutting blowpipe, and cutting attachment. All have detachable valve body construction to permit quick changing from welding to cutting and vice versa.



Among the principal features of the welding blowpipe (top illustration) are individual mixers for facilitating flame adjustment and giving definite resistance to flashback. The new cutting blowpipe and cutting attachment also incorporate improved design principles.—The Linde Air Products Co., 30 E. 42nd St., New York, N. Y.

Underwriters Approve Air Filters

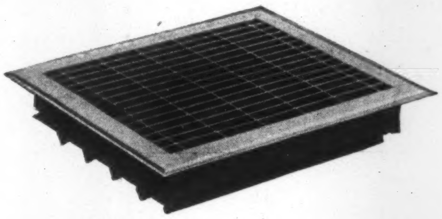
No. 1730—Announcement was recently made that the "Airmat Type PL" air filter has been tested and listed by the Underwriters' Laboratories and now carries their label. When equipped with "Type G" media it is listed in Class 1 and when equipped with the "Type F" media it is listed in Class 2.

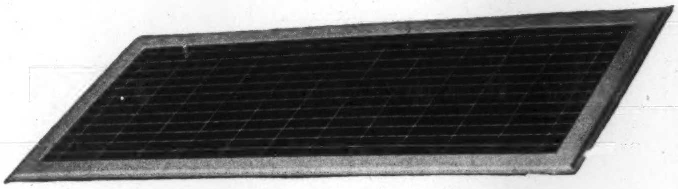
Class 1 filters are those which when clean do not contribute fuel when attacked by flame and which emit only negligible amounts of smoke. Class 2 filters are those which when clean burn moderately when attacked by flame, or emit moderate amounts of smoke, or both.—American Air Filter Co., Inc., 107 Central Ave., Louisville, Ky.

Surplus Strength and Simple Beauty in

DURABILT

Floor Registers and Cold Air Faces





A register of fine appearance and extra sturdy construction, the DuraBilt is one of the most popular numbers in the entire Auer Line. Inbuilt strength results from amply heavy materials and rigid *crossbar* assembly, the bars which form the faces being mortised and locked at every cross-joint and also securely interlocked to frame. Frame is welded and reinforced at corners and the finished product is an example of sound and durable workmanship, with close fitting joints that will not pull apart. Bar assembly is tight and true, and faces are level.

The DuraBilt is furnished in a complete range of sizes and finishes for both register and intake use, in standard mesh or if preferred in narrow mesh. Where strength counts, as well as trim appearance—try these splendid DuraBilt Registers! We know you will be more than pleased with them.

▶ *Auer Register Book No. 39, listing and illustrating Auer's complete line of attractive registers and faces for all warm air heating and air conditioning uses, promptly mailed to you on request.*

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3608 Payne Avenue Cleveland, Ohio

AUER REGISTERS
& GRILLES
For Air Conditioning *and* Gravity

WE SAVED

THREE CARS OF COAL

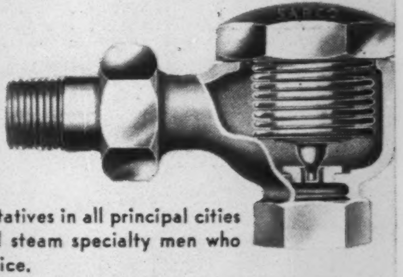
AND $800 IN CASH

Floral Avenue Greenhouses, Mt. Clemens, Michigan, installed 400 Sarco Type H and FT Traps. They intentionally purchased $800 less coal and had three cars left over at the end of the year. "Better heating, absolutely no maintenance difficulties, and Sarco Traps have saved us more than twice their original cost each year."

There are a dozen reasons for Sarco Efficiency: The Sarco Radiator Trap has a substantial factor of safety. It tests hydrostatically without damage up to 75 pounds. It is the only trap with heavy wall, helically corrugated bellows giving positive lifting power.

Sarco Heating Specialties, Radiator Traps, Valves, Main Drip Traps, Strainers, Alternating Receivers and Temperature Control are all made by Sarco in the new Sarco plant devoted exclusively to steam heating systems and accessories. You get 25 years' experience in manufacture and application —and a co-ordinated Sarco System, with all parts designed to work smoothly in unison.

Sarco Type H Radiator Trap



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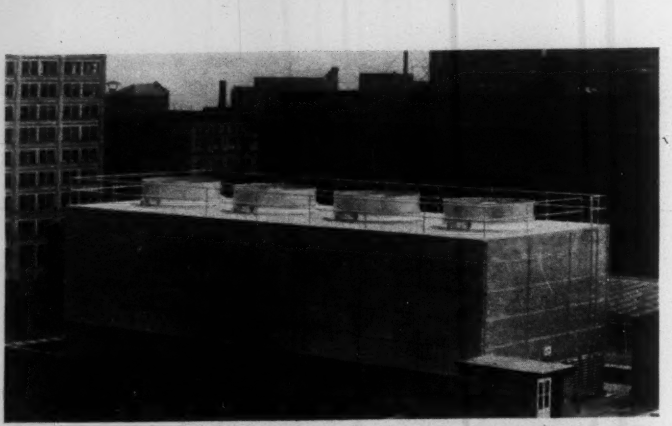

MARLEY
Induced Draft
COOLING TOWERS

Set new standards in

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•
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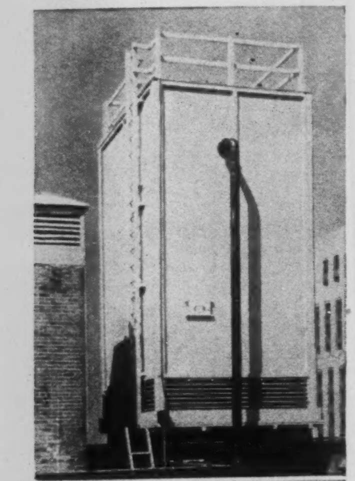
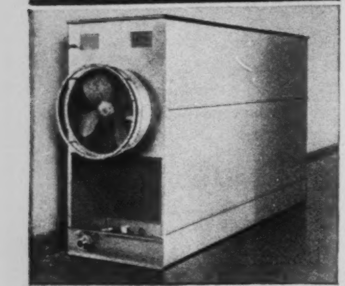
LOW FIRST COST





MARLEY engineering has made the advantages of the induced draft cooling tower available to an extremely wide range of applications, from the largest to the smallest and in any type of service. Their well-known structural, mechanical and operating characteristics bring owners unequalled performance, dependability and long life.

Large towers, like the 4-fan above, and the single-fan at left, are of either steel or Redwood. Small steel towers in indoor (shown lower left) or outdoor models are economical on even the smallest loads.

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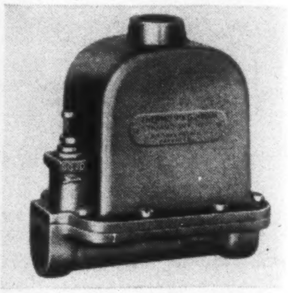
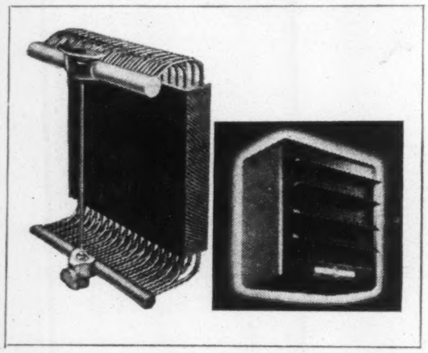
Thermostatic Fluid Mixing Valve



No. 1731—A method of maintaining constant temperatur without electrical connections is embodied in the new "Guardian" thermostatic fluid mixing valve. It is offered for use in conjunction with constant temperature water jackets, circulating water tanks, laboratory water supply, etc., and eliminates the necessity of room storage tanks. Constant temperature is maintained by proportioning the amount of cold water mixed with the hot water and the effect of pressure changes in the supply lines is eliminated by thermostatically controlled orifices. The valve is manufactured in four sizes—15, 25, 45 and 60 gpm—at 45 lb per sq in. pressure.—Thermo-Mix, Inc., 129 Grand Ave., Brooklyn, N. Y.

Improved Unit Heaters



No. 1732—A patented "Stay Tube" has been built into the heating element of the propeller fan "hiJet" unit heater between the supply and return headers to allow any entrained moisture — which might otherwise be carried over into the heater—to drain directly from the supply to the return header without entering the other tubes of the heating element. If this entrained moisture is corrosive it will first affect the "Stay Tube," which is made four times as heavy as the other tubes in the heating element, thus prolonging the life of the unit, the maker says.

Another function of the improved design is to maintain proper relationship between the supply and return headers to leave the loops free to take care of only the expansion and contraction between individual tubes.—Herman Nelson Corp., 2nd St., Moline, Ill.

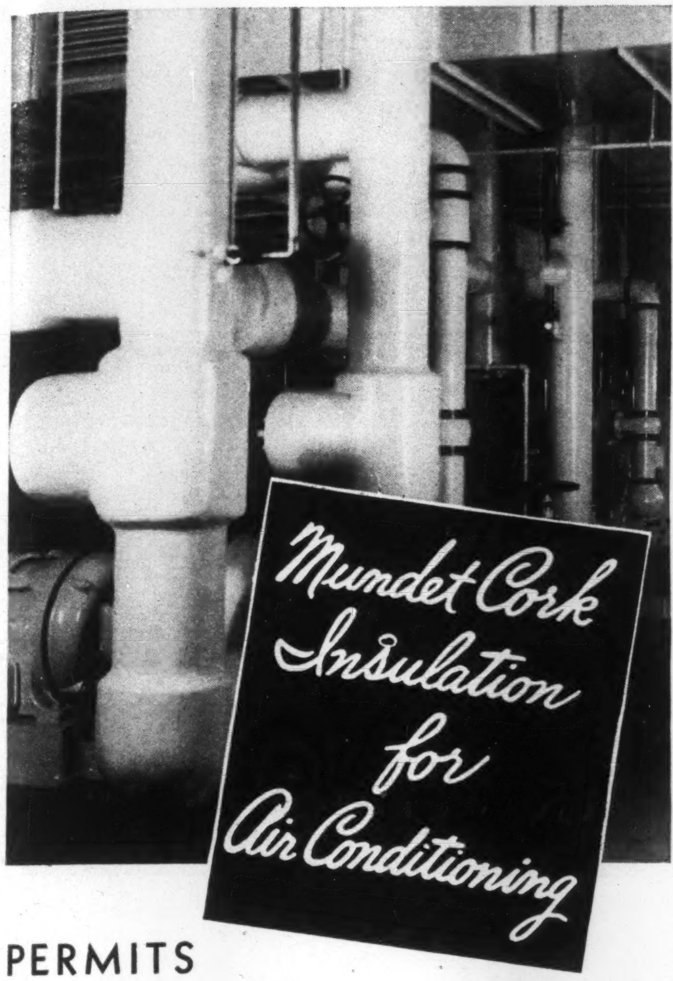
Booklets, Reports and Papers

Air Conditioning for Hay Fever Relief

A bulletin on air conditioning for the relief of cedar pollen hay fever has been published by the University of Texas, Austin, Texas, and a limited number of copies are available for free distribution. It was written by Alvin H. Willis, Research Assistant, and Howard E. Degler, Professor of Mechanical Engineering, and is 48 pages in length.

The studies reported show that cedar pollen hay fever as experienced by persons in Texas and northern Mexico during the winter months can be relieved by an air conditioning unit such as that developed by the University of Texas, which is described in detail. The unit supplies outside air to a room at a rate sufficient to build up a positive pressure in the room to prevent inleakage of pollen laden air, the air is filtered to remove all but traces of pollen, and is heated before being discharged into the room (because generally air at a low temperature with little pollen has the same effect on the patient as air at a high temperature heavily laden with pollen).

A discussion is given on the part that cedar pollen takes in causing hay fever.



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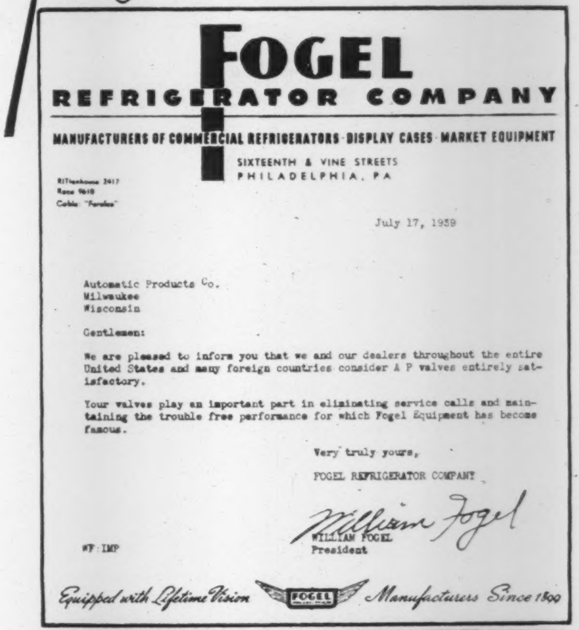

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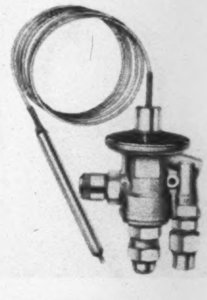

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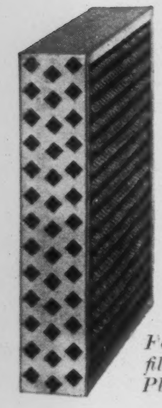

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Dehydration of Forage Crops

Information Bulletin No. 3 of Bituminous Coal Research, Inc., 803 Southern Bldg., Washington, D. C., is a discussion of the use of bituminous coal in the dehydration of alfalfa and other forage crops and was prepared by E. R. Kaiser, Assistant Fuel Engineer. It is available without charge.

The bulletin includes information on artificial drying vs. sun curing, types of dryers, a discussion of fuels for dehydration, and an appendix showing heat calculations and calculations for design of a coal fired furnace.

Schools and Study Courses

Welding Courses

The John Huntington Polytechnic Institute, 3133 Euclid Ave., Cleveland, Ohio, has announced continuation of the five day courses in arc welding design and practice which it has sponsored in collaboration with The Lincoln Electric Co. Included are talks and demonstrations on welded design, as well as discussions of problems on welding procedures and technique.

Courses will be offered the weeks of December 4, January 8, February 12, March 25, April 22, and May 27. Each session will be under the direction of E. W. P. Smith, welding consulting engineer.

Conventions and Expositions

Air Conditioning Conference: November 10-11, Lehigh University, Bethlehem, Pa., under sponsorship of American Society of Refrigerating Engineers. Includes sessions on industrial air conditioning; air conditioning of perishables; air conditioning of hospitals, apartments, and hotels; and air conditioning in transportation. Chairman, Prof. B. E. Jennings, Lehigh University, Bethlehem, Pa.

Air Hygiene Foundation: Annual meeting, November 14-15, Mellon Institute, Pittsburgh Pa. Theme of meeting to be "healthy workers make healthy business." Managing Director, Dr. H. B. Meller, 4400 Fifth Ave., Pittsburgh, Pa.

American Management Association: Production conference, November 15-16, Palmer House, Chicago, Ill. Speakers will discuss how American industry can control unit costs through more efficient plant facilities, with a session on heating, ventilation and air conditioning as a factor in production efficiency at 10:45 a.m. Nov. 16, and one on effect of air conditioning on employees comfort, health and efficiency at 2:30 p.m. Headquarters office, 330 W. 42nd St., New York, N. Y.

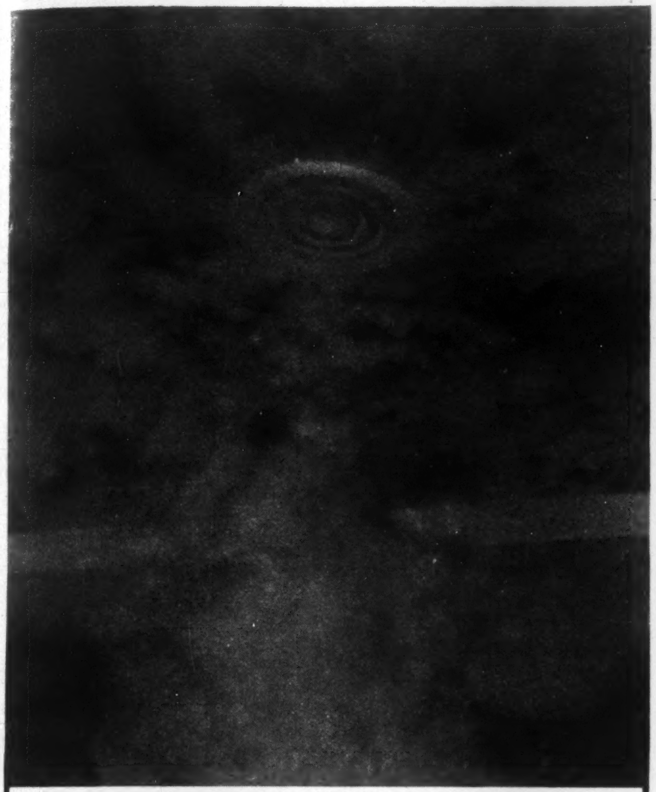
American Society of Mechanical Engineers: Annual meeting, December 4-8, The Bellevue-Stratford, Philadelphia, Pa. Headquarters office, 29 W. 39th St., New York, N. Y. To include discussion on heating and ventilating the modern airplane, a session on heat transfer, and a symposium on piping design.

Refrigeration Service Engineers Society: Annual convention, January 15-18, Chicago, Ill. Secretary, H. T. McDermott, 433 N. Waller Ave., Chicago, Ill.

Refrigeration and Air Conditioning Exhibition: January 15-18, Stevens Hotel, Chicago, Ill. Exhibition manager, R. M. McClure, 111 W. Washington St., Chicago, Ill.

American Society of Refrigerating Engineers: Annual meeting, January 17-19, Blackstone Hotel, Chicago, Ill. Secretary, D. L. Fiske, 37 W. 39th St., New York, N. Y.

American Society of Heating and Ventilating Engineers: Annual meeting, January 22-25, 1940, Hotel Statler, Cleveland, Ohio. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.



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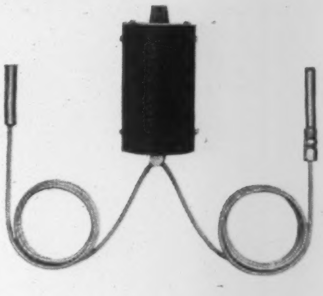

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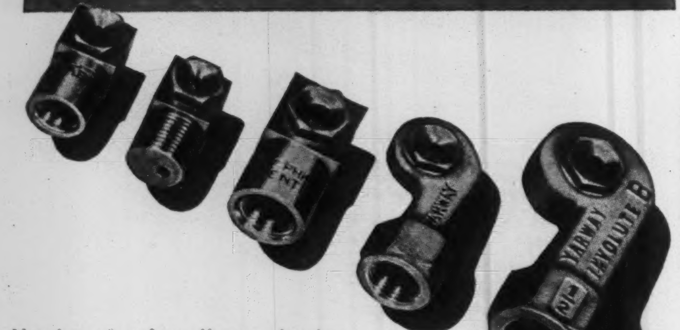

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Sixth International Heating and Ventilating Exposition: January 22-26, 1940, Lakeside Hall, Cleveland, Ohio. Manage Charles F. Roth, International Exposition Co., Grand Centra Palace, New York N. Y.

National Warm Air Heating and Air Conditioning Association: Annual convention, January 22-24, Hotel Hollenden, Cleveland, Ohio. Managing Director, Allen W. Williams, 5 E. Lon St., Columbus, Ohio.

Book Reviews

Edison Electric Institute Issues Statistical Report on Air Conditioning

["Air Conditioning Installations—Statistical Report on 141 Electric Utility Companies." 1st ed. 1939. 8½ x 11 in., paper bound. Published by Edison Electric Institute, 420 Lexington Ave., New York, N. Y. Price, $1.00.]

The long awaited first compilation of air conditioning installations by the air conditioning committee of the EEI has been published and inaugurates an annual statistical service on this subject. This first report presents data from 141 utility companies and it is expected that in later surveys additional companies will be included. The committee also anticipates that it may later be feasible to publish semi-annual or even quarterly reports.

The data presented are as of March 31, 1939, and total 39,747 installations and 760,851.38 hp, the horsepower figure including all auxiliaries. Of these installations, 8652 are self-contained conditioners which account for 18,226.71 hp.

The report for each utility company is separate and shows number and horsepower of installations prior to 1938, during 1938, for the first quarter of 1939, and the total as of March 31. They are broken down according to application into residential, commercial and industrial, and further broken down into subclassifications of these three. Included also are data on installations that use power other than central station electric, self-contained conditioners of 1½ hp or less, and 2 hp or larger, total population served, and total meters served.

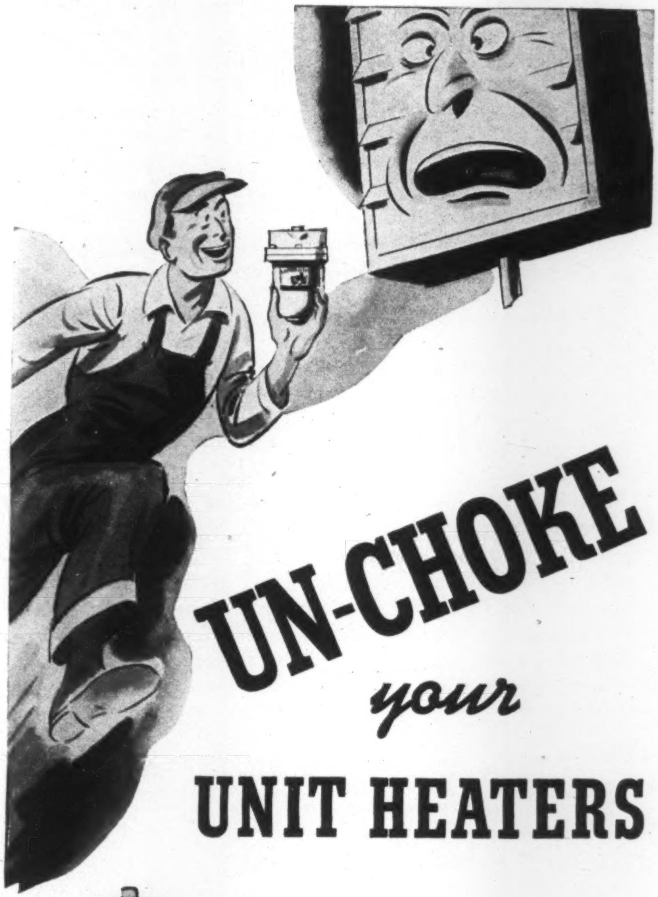
E. W. Gray of the Oklahoma Gas & Electric Co. is chairman of the air conditioning committee and the other members are E. W. Freund, Union Electric Co. of Missouri, E. M. Jergensen, Central Arizona Light & Power Co., G. L. MacGregor, Dallas Power & Light Co., A. D. Marston, Kansas City Power & Light Co., H. H. Mather, Philadelphia Electric Co., C. H. Randolph, Wisconsin Electric Power Co., S. S. Sanford, The Detroit Edison Co., and R. H. Ten Eyck, Consolidated Edison Co. of New York, Inc.

Exhaust Hood Design

["Principles of Exhaust Hood Design," by J. M. DallaValle, P. A. Sanitary Engineer, U. S. Public Health Service. 1939. 108 pp., 8 x 10½ in., mimeographed, paper cover. Published by U. S. Public Health Service. Limited number of copies for free distribution.]

This book is largely concerned with control of industrial hazards causing occupational diseases, the author points out in his preface, and the basic principles of hood design, which form two sections of the work, are applicable to all types of conditions where local exhaust ventilation can be used. The fundamental aspects of flow into an opening are discussed theoretically, and from a practical standpoint the author has endeavored to give only such examples of hood design as are outstanding.

The eight parts into which the work is divided discuss theory of flow into an opening; velocity characteristics of common types of unobstructed openings experimentally determined; velocity contours of hoods with special boundary conditions; criteria for determining hood effectiveness; hoods for dust control; hoods



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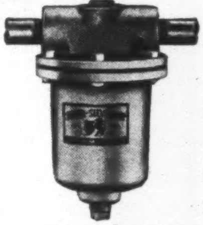

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- ☐ Bridge Engineering
- ☐ Building Estimating
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- ☐ Fire Bosses
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for the control of fumes, mists, vapors, and gases; grille type openings under suction; and hood entrance losses. There is also an appendix on mathematical theory of velocity contours and stream lines.

Much of the fundamental work discussed was done at the Harvard School of Public Health some 10 years ago, and the author's papers dealing with the subject of exhaust hoods are included and expanded. More than half of the material given is new and hitherto unpublished.

Air Conditioning Handbook

["Manly's Air Conditioning Handbook." 1st ed. 1939. 112 pp., 5½ x 8½ in., bound in artificial leather and reproduced from typewritten pages. Published by H. P. Manly, Wilmette, Ill. Price, $1.50.]

This little book has been prepared for those who have not the advantage of an engineering education and who are interested in preliminary field work on installations of small and medium size. It includes nothing but reference material as all descriptive and explanatory matter not of permanent usefulness has been excluded.

The manner of using the tables and formulas in practice is illustrated by typical problems and there is a psychrometric chart attached to the back of the cover. Sections are included on psychrometric data, air conditioning survey, cooling data, thermal resistance, cooling loads, circulation and balancing, refrigeration, heating, distribution, air flow, ducts, and fans.

Smoke Prevention Association Manual

["Manual of Ordinances and Requirements." 1939. 172 pp., 6 x 9 in., paper bound. Published by Smoke Prevention Association, 139 N. Clark St., Chicago, Ill. Price, 50c.]

The 1939 edition of the SPA's manual of ordinances and requirements is similar in format and content to previous editions.

Statement of Ownership and Management of Heating, Piping and Air Conditioning for October 1, 1939

The following is a statement of ownership, management, etc., as required by the Acts of Congress of August 24, 1912, and March 3, 1933, of HEATING, PIPING AND AIR CONDITIONING, published monthly at Chicago, Ill., for October 1, 1939:

State of Illinois, County of Cook, ss: Before me, a Notary Public in and for the State and county aforesaid, personally appeared F. P. Keeney, who, having been duly sworn according to law, deposes and says that he is the business manager of HEATING, PIPING AND AIR CONDITIONING, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication, for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:
Publisher, Keeney Publishing Company, Chicago, Illinois.
Editor, Chas. E. Price, Chicago, Illinois.
Managing Editor: C. M. Burnam, Jr., Chicago, Illinois.
Business Manager, F. P. Keeney, Chicago, Illinois.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)
Keeney Publishing Company, 6 North Michigan Ave., Chicago, Illinois. Stockholders: F. P. Keeney, Chicago, Illinois; W. J. Osborn, Fairfield, Conn.; R. Payne Wettstein, Chicago, Illinois; Chas. E. Price, Chicago, Illinois; Robert A. Jack, Cleveland Heights, Ohio.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

F. P. Keeney,
Business Manager.

Sworn to and subscribed before me this 27th day of September, 1939.
Grace E. Waymire.
(SEAL) [My commission expires Feb. 10, 1942.]

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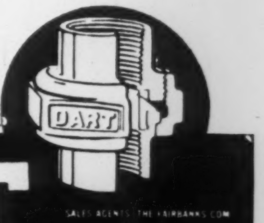

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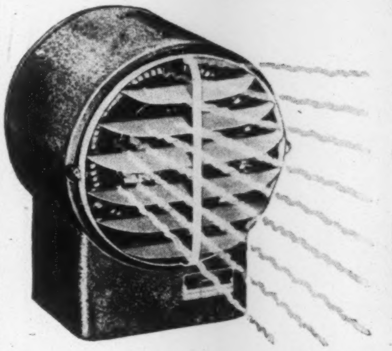

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Chromalox electric air heater. Adjustable louvers for directing warm air flow. Can be set up anywhere. In sizes from 2 to 15 Kw. Other types available for various requirements.

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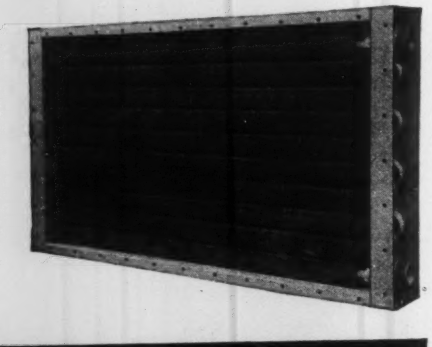

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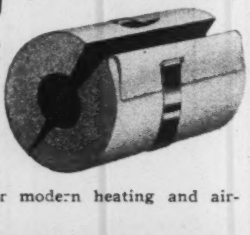

—with an "All Service" liner—makes possible the efficient use of the same pipes for cold water circulation in summer and hot water in the heating season. Furnished in 36-inch long sections, with cotton duck jackets and bands in ½, ¾, 1-in. double ½-in. and double ¾-in. thicknesses.

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It includes the papers read before the 33rd annual convention o the association, among which were discussions of the preparatio and quality control of steam coals, properties of coals that affec burning characteristics, what the railroads are doing to preven smoke, data on fuel oil and its combustion, air pollution and disease, production of smoke and fly ash in the operation of underfeed stokers, requirements that should be incorporated in a smok ordinance, instructions in burning fuels smokelessly and economically, what smoke abatement means to a community, the Ringelmann chart method of determining smoke violations, relation o combustion space and setting height to smoke when firing bituminous coal with underfeed stokers, reducing fly ash emissio from chimneys, and others.

The model smoke abatement ordinance adopted by the SPA i also included as is information on the Stoker Manufacturers Association uniform rating method.

Stoker Handbook

["Stoker Handbook," by H. D. Airesman, Consulting Engineer. 1st ed. 1939. 201 pp., 5 x 7½ in., clothbound. Publishe by J. B. Lippincott Co., 227 S. 6th St., Philadelphia, Pa. Price $3.00.]

This little book is designed to be a practical guide for everyday use by those who install, sell or operate small commercial an domestic stoker equipment.

Chapters are included on bituminous underfeed stokers, anthracite underfeed stokers, bituminous coals and their classifications, anthracite, combustion, heating, hot water heating, estimating coal consumption, sizing stokers, warm air heating, air conditioning, high pressure boilers, installation, operation and care o stokers, and boiler ratings.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 135. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 3343. BOILERS: National Radiator Co., 221 Central Ave., Johnstown, Pa. 16 p. booklet (NRC Handbook—Section IV) giving specifications on "Premier" steel boilers, with description of construction, ratings, and complete engineering data.

No. 3344. BRONZE BEARINGS: Johnson Bronze Co., 460 S. Mill St., New Castle, Pa. Slide rule giving information on over 800 sizes of standard stock bronze bearings for convenience of engineers, designers and draftsmen who find it inconvenient to keep a copy of the manufacturer's regular catalog on their desks. Requests should be made on business letterhead.

No. 3345. CONTROLS: Julien P. Friez & Sons, 4 N. Central Ave., Baltimore, Md. 4 p. bulletin (W) on automatic protection against condensation on windows, describing the improved "Windowstat" and giving instructions for its location, adjustment, and other information.

No. 3346. COOLING TOWERS: The Marley Co., 3001 Fairfax Rd., Kansas City, Kans. 24 p. bulletin (600) on forced draft cooling towers for air conditioning, describing and attractively illustrating them, explaining their advantages, and with a thorough description of construction features. Typical specifications are shown and installations are listed.

No. 3347. DRIVES: Allis-Chalmers Mfg. Co., Milwaukee, Wis. Issue of house organ "Texrope Topics" in new and modern format, with many illustrations on "Texrope" v-belt drives for many applications.

No. 3348. DUST FILTERS: Ruemelin Mfg. Co., 3860 N. Palmer St., Milwaukee, Wis. 4 p. bulletin (24-C) on tubular bag type dust filters, describing features, illustrating construction and giving dimensions and capacities.

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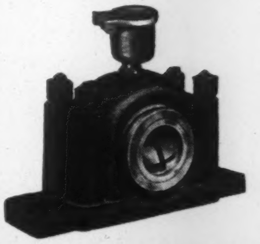

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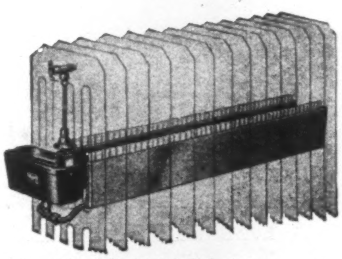

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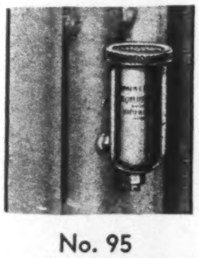

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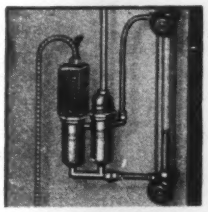

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No. 3349. FLAME DETECTORS: Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, Ohio. 8 p. bulletin (210) on flame detectors for warning boiler operators of possible furnace explosions that may result from loss of ignition, describing and illustrating construction and application of device which affords protection.

No. 3350. HOLLOW SCREW PRODUCTS: Allen Mfg. Co., Hartford, Conn. 20 p. catalog (39) on hollow screw products, including set screws, locking screws, pipe plugs, special screws, wrench and screw assortments, etc.

No. 3351. LEATHER BELTING CALCULATOR: J. E. Rhoads & Sons, 35 N. 6th St., Philadelphia, Pa. Slide rule type of leather belting calculator based on ALBA tables, giving data on pulley rpm, diameter and belt speed, horsepower per inch of belt width, etc. Requests should be made on business letterheads.

No. 3352. METALS: International Nickel Co., Inc., 67 Wall St., New York, N. Y. 8 p. bulletin on "rustless strength in vital spots" discussing uses of "Monel" in buildings for air conditioning, sprinkler, sterilizer, heating, pump, and tank equipment with illustrated examples and engineering and comparative data.

No. 3353. MOTORS: General Electric Co., 1 River Rd., Schenectady, N. Y. 2 p. data sheet (GEA-98B) on single phase repulsion brush shifting motors, ¼ to 3 hp. 4 p. data sheet (GEA-1698A) on wound rotor induction motors. 4 p. data sheet (GEA-1807B) on squirrel cage induction motors, 100 to 1500 hp. Each of these describe features of construction and give data on applications and control.

No. 3354. MOTORS: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 4 p. booklet (F-8488) on shaded pole and companion a-c or d-c series wound motors of 1/125 to 1/30 hp for unit heaters, fans, air conditioners, humidifiers, etc.

No. 3355. PAINT: American Chemical Paint Co., Ambler, Pa. 4 p. leaflet describing "Kemick" chemical paint for exhaust lines, boilers, smoke pipes, flues and other highly heated meta surfaces.

No. 3356. PIVOTED MOTOR DRIVES: Rockwood Mfg. Co., 1801-2001 English Ave., Indianapolis, Ind. 16 p. price shee bulletin (861) on pivoted motor drives for electric motors an gas engines, explaining the basic principles underlying operation, and giving price and dimensional information for th various types available for different kinds of applications.

No. 3357. PRESSES: Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. 38 p. bulletin (58-H) on open back inclinable presses incorporating a number of developments.

No. 3358. PULLEYS: Rockwood Mfg. Co., 1801-2001 English Ave., Indianapolis, Ind. 16 p. price sheet booklet (860) on paper pulleys for industrial use, containing a complete list o stock sizes, describing construction and giving specification and ordering information.

No. 3359. PUMPS: Allis-Chalmers Mfg. Co., Milwaukee, Wis. 36 p. bulletin (B6018) on "how to get more gallons at less cost," featuring "SSUnit" close coupled pumps and their construction, and giving performance data, capacity tables, dimension sheets, friction tables and other information.

No. 3360. PUMPS: Byron Jackson Co., 2150 E. Slauson Ave., Los Angeles, Calif. Folder on "Submersible" deep well pumping units featuring a large cross section view in colors, illustrating construction and the various parts of the unit.

No. 3361. PUMPS: Pomona Pump Co., 206 E. Commercial St., Pomona, Calif. 4 p. bulletin on new jet pump with a molded plastic jet, and motor and pump shaft in one piece, illustrating installation and giving operation and engineering data.

No. 3362. STEAM TRAPS: Armstrong Machine Works, 874 Maple St., Three Rivers, Mich. 36 p. steam trap book and catalog including 18 pp. devoted to handbook material on rates of condensation, heat transfer, pipe sizes, piping layouts, maintenance, etc. Equipment covered by specific recommendations

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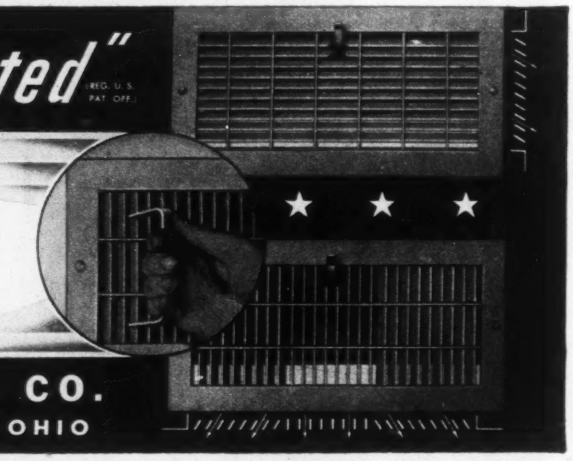

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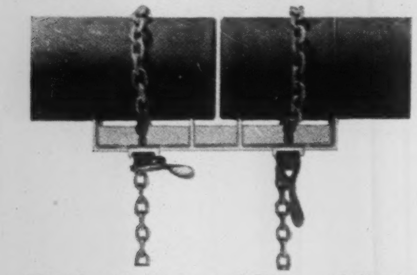

JUST A MINUTE!

Did you make a note of the important message on page 38?

ncludes unit heaters, jacketed kettles, syphon drained cylinders, water heaters, pipe coils, steam mains and steam purifiers.

No. 3363. SWITCHES: General Electric Co., 1 River Rd., Schenectady, N. Y. 4 p. bulletin (GEA-821G) on diaphragm type pressure and vacuum switches for maximum pressures of 3, 40, 80, 160, 300 and 5000 lb, and maximum vacuum of 28 in.

No. 3364. WATER CONDITIONING: The Permutit Co., 330 W. 42nd St., New York, N. Y. 8 p. bulletin (2233) on electro-chemical feed for apportioning chemicals in wet form at a constant or variable rate.

No. 3365. WELDING: Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio. 16 p. bulletin giving 101 welding ideas for low cost maintenance, illustrating and describing a wide variety of repair, fabrication and structural applications of arc welding in various industries and for pipe lines.

No. 3366. WELDING FUME COLLECTORS: Ruemelin Mfg. Co., 3860 N. Palmer St., Milwaukee, Wis. 4 p. bulletin (37-C) on welding fume collectors, describing their importance, illustrating use, and giving dimension and construction data.

Heating, Piping and Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [11-39]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

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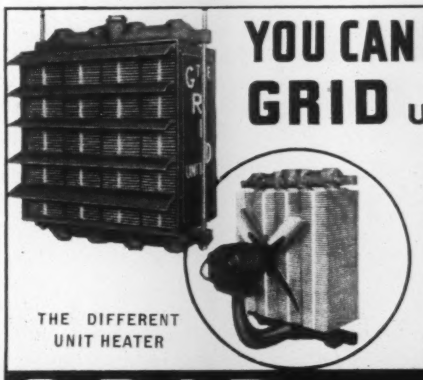

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Condensing Units for every commercial refrigeration and air-conditioning requirement

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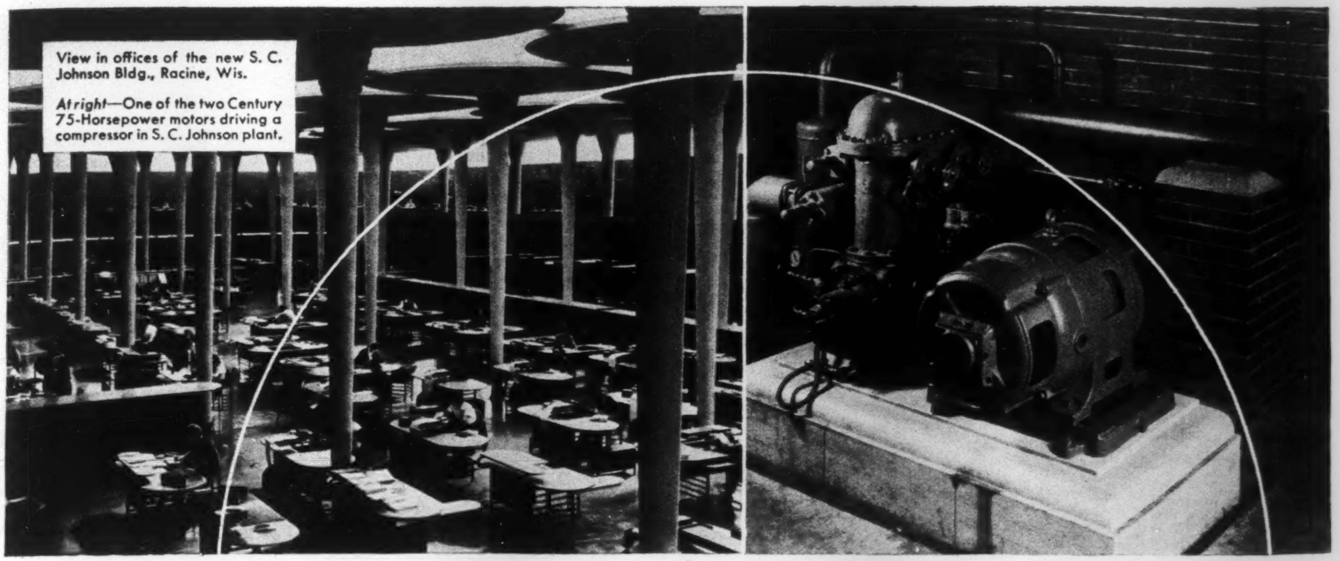

View in offices of the new S. C. Johnson Bldg., Racine, Wis.

At right—One of the two Century 75-Horsepower motors driving a compressor in S. C. Johnson plant.

Added Proof of the Value of Century Specified Motor Performance in Air Conditioning

TWO 75-horsepower Century Slip Ring Induction Polyphase Motors were selected to drive two refrigeration compressors in the air conditioning installation in the new building of S. C. Johnson & Son, makers of Johnson's Wax, at Racine, Wisconsin. The air conditioning system was designed and installed by Westerlin & Campbell Company, Chicago, the complete building being designed by Frank Lloyd Wright, internationally famous architect.

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Such acceptance by the client, engineers and architect responsible for this famous building, is added recognition of the value of Century's Specified Motor Performance applied to air conditioning.

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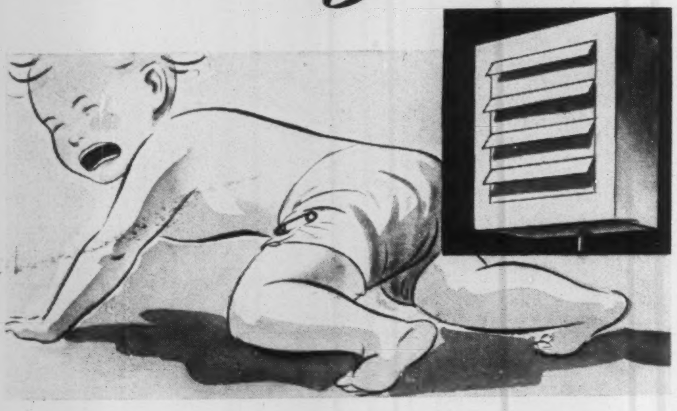
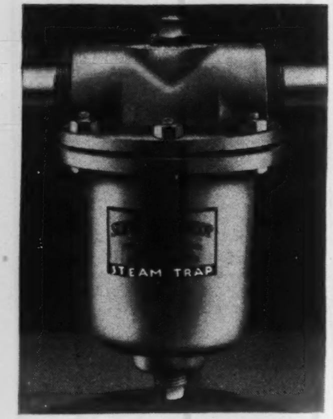
A Cold Bottom



Means it's time to change



● A unit heater with a cold bottom is a unit heater that needs a change of steam traps—a change to Anderson Super-Silvertop. The change is needed because the old trap is not removing air and condensate from the system. That is why the unit is cold—it isn't full of hot, dry steam.

Anderson Super-Silvertop steam traps keep a unit heater bone dry and free of entrained air at all times. Over fifty years of steam trap manufacturing experience back the design of this engineered steam trap. It has guided bucket, straight-in-line and built-in elbow piping, ease of inspection and extra long service life.

Examine your unit heaters—remember that a cold bottom means it's time to change—to Anderson Super-Silvertop.

THE V. D. ANDERSON COMPANY
1949 WEST 96TH ST. • CLEVELAND, OHIO

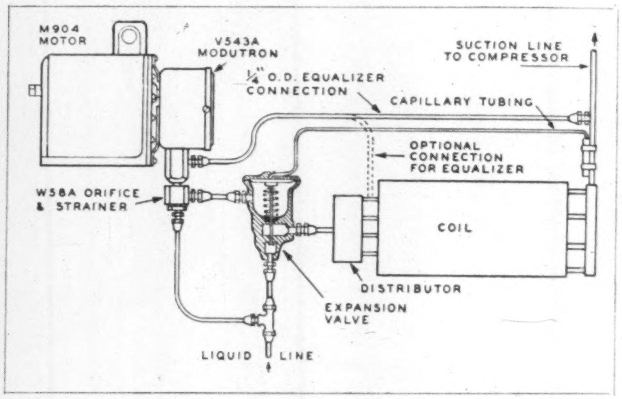
Super-Silvertop
STEAM TRAPS

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 126. Add the new products and companies listed here to your Directory Section which you received in your January, 1939, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Air Conditioning Control

No. 1733—The "Modutron" system has been developed for modulating the refrigerating effect on direct expansion air conditioning systems, both existing and new installations. It may be applied to any installation employing thermostatic expansion valves with the usual external equalizer. A small electrically operated valve is installed in the equalizer line of the expansion valve; the electric motor which operates the valve is modulated by temperature, humidity, pressure or any other condition to be controlled and opens the valve wide when maximum cooling is required. Under these conditions the system operates in a normal manner at maximum capacity as determined by the expansion valve.



If less refrigerating effect is required, the motor moves the valve to a more closed position, reducing the effect of the external equalizer on the expansion valve. Since the inlet pressure to the coil will be higher than the outlet pressure because of pressure drop through the distributor and coil, the expansion valve is then affected by a higher pressure than when the "Modutron" is wide open. As a result, the expansion valve operates at a higher superheat. When the "Modutron" is completely closed, the expansion valve is affected only by the pressure of the refrigerant leaving the valve, and on most systems the capacity will then be reduced to about 60 or 70 per cent of full load capacity. On jobs requiring further capacity reduction, the orifice may be added.

The makers state that the capacity reduction is secured without changing the air velocity over the coil, and that it is thus possible to modulate to a lower suction pressure than otherwise without danger of frosting the evaporator.

Pneumatically operated "Modutrons" and direct temperature operated models with a remote bulb are to be available at a later date.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn.

Arc Welders and Electrodes

No. 1734—The new small arc welding machine illustrated is known as the "Shield-Arc Junior" and is built for use in conjunction with an engine or electric motor drive. It is rated at

SPECIFICATIONS

for Air Conditioning and Refrigerating Installations

ONE of the most exacting duties of an architect or engineer is to draw concise and inevasible specifications for the guidance of contractors and the protection of his client. Such specifications should be founded on the specifications and regulations of nationally known and accepted authoritative bodies interested solely in public welfare.

The National Board of Fire Underwriters, Underwriters' Laboratories, Inc., and the National Fire Protection Association are institutions of this class. Each has contributed to the fundamental specifications covering air conditioning and refrigerating machinery. Every architect and engineer should have a copy of their rules and specifications:

(1) NBFU Pamphlet No. 90 entitled, "Regulations of the National Board of Fire Underwriters for the Installation of Air Conditioning, Warm Air Heating, Air Cooling, and Ventilating Systems as Recommended by the National Fire Protection Association." (This is also the A. S. A. standard Z33.2). Address National Board of Fire Underwriters at 85 John Street, New York City, or 222 West Adams Street, Chicago, Illinois, or Merchants Exchange Building, San Francisco, California.

(2) Underwriters' Laboratories, Inc., Subject 207, "Standard for Air Conditioning and Commercial Refrigerating Equipment." Address 207 East Ohio Street, Chicago, Illinois.

(3) Underwriters' Laboratories, Inc., Subject 207, "Standard for Unit Refrigerating Systems." Address 207 East Ohio Street, Chicago, Illinois.

(4) Underwriters' Laboratories Report MH2375 entitled, "The Comparative Life, Fire, and Explosion Hazards of Common Refrigerants." Supplies of this publication are exhausted at the Underwriters' Laboratories, but may be consulted in most public libraries in the United States. Reprints have been made by Kinetic Chemicals, Inc., Tenth and Market Streets, Wilmington, Delaware, and are available at $1.00 each.

It is often hard to compare values and capacity of the equipment offered and so it is well to provide that the contractor shall express his rating according to the following methods:

(1) "Standard Method of Rating and Testing Mechanical Condensing Units"—Price 15¢.

(2) "Standard Method of Rating and Testing Air Conditioning Equipment"—Price 20¢.

These standards are obtainable from the American Society of Refrigerating Engineers, 37 West 39th Street, New York City.

An example of concise yet comprehensive specification formulation that everyone should have may be obtained for 5¢ from the Superintendent of Documents, Government Printing Office, Washington, D. C. It is "Federal Specification for Air-Conditioning Units (Room-Coolers); Electric-Motor-Driven, Portable," 00-A-361 of July 23, 1938.

By following these rules you avoid any possibility of penalty to your client in insurance rates and promote safety of life and property. The "Freon"* refrigerants meet the requirements of these specifications.

KINETIC

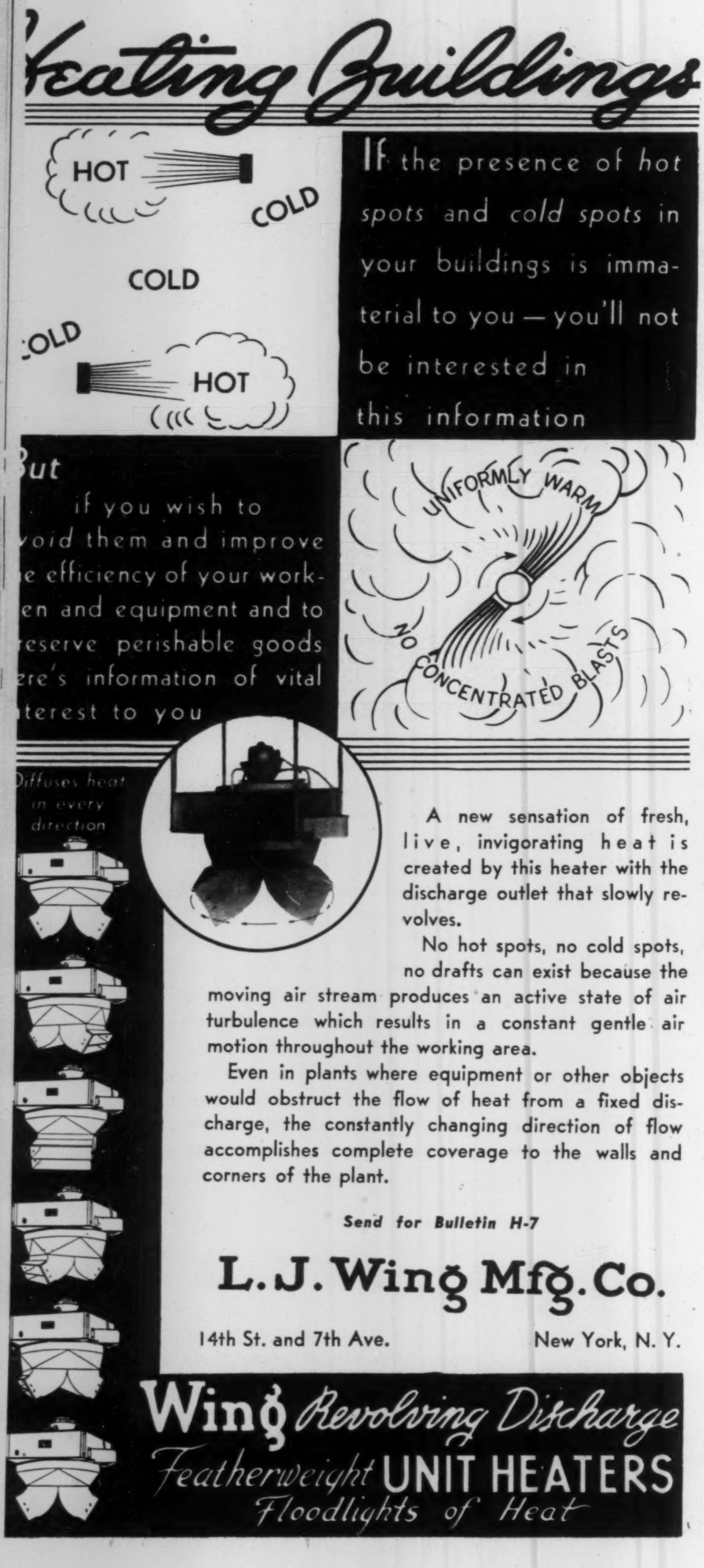
FREON

REG. U. S. PAT. OFF.

safe refrigerants

**"Freon" is Kinetic's registered trade mark for its fluorine refrigerants.*

KINETIC CHEMICALS, INC., TENTH & MARKET STREETS, WILMINGTON, DELAWARE



Heating Buildings

If the presence of *hot spots* and *cold spots* in your buildings is immaterial to you — you'll not be interested in this information

ut

if you wish to
void them and improve
e efficiency of your work-
en and equipment and to
reserve perishable goods
ere's information of vital
terest to you

A new sensation of fresh, live, invigorating heat is created by this heater with the discharge outlet that slowly revolves.

No hot spots, no cold spots, no drafts can exist because the moving air stream produces an active state of air turbulence which results in a constant gentle air motion throughout the working area.

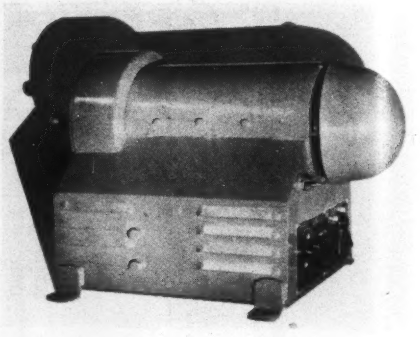
Even in plants where equipment or other objects would obstruct the flow of heat from a fixed discharge, the constantly changing direction of flow accomplishes complete coverage to the walls and corners of the plant.

Send for Bulletin H-7

L. J. Wing Mfg. Co.

14th St. and 7th Ave. New York, N. Y.

Wing *Revolving Discharge*
Featherweight **UNIT HEATERS**
Floodlights of Heat



200 amp and its current range, welding duty, 30 volt arc, is 60 to 250 amp. Its feature is a system of voltage and current control known as "Dual Continuous Control" made available for the first time on a small belt driven model.

The same manufacturer has also announced a new 300 amp diesel engine driven arc welder equipped with gasoline engine starting rather than a motor starter with storage batteries. It uses only 1.5 gal per hr of fuel at full load operation, the maker states.

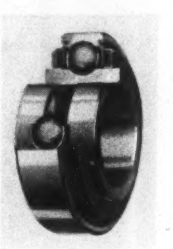
Also announced is a new arc welding electrode ("Fleetweld 10") which facilitates finishing operations on welded parts by eliminating the need of dressing or smoothing welded seams in many applications, according to the maker.—Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

Sight Glasses for Pipe Lines

No. 1735—A visible flow fitting for use in process and power plant piping may be used to provide continuous checks on operation of equipment and observe the fluid in flow under pressures up to 125 lb per sq in. It is available in six sizes for 2½, 3, 4, 5, 6, and 8 in. lines. The body is of cast iron, the window frame is steel, and the windows are made of "Pyrex" glass. Windows are 4¼ in. in diameter for all sizes and all sizes measure 13¼ in. between finished surfaces.—Cochrane Corp., 3161 N. 17th St., Philadelphia, Pa.

Mechanical Seal for Bearings

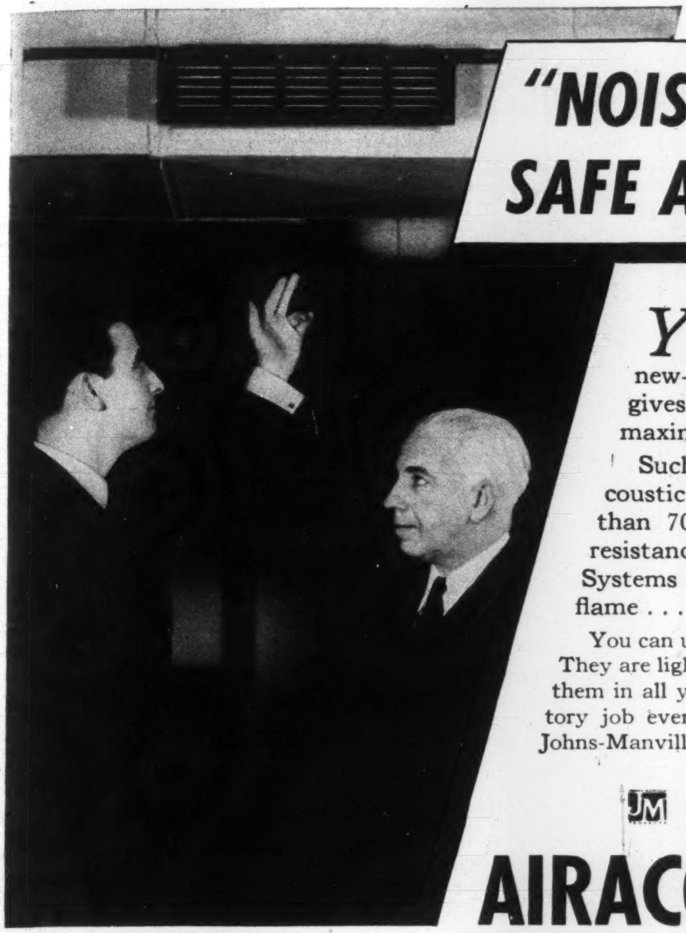
No. 1736—A new seal design known as the "Mechani-Seal" for bearings is an integral part of the bearing itself. Two steel plate shields, separated to form a trap, serve as the innermost members and are attached to the outer bearing ring. Another steel plate, pressed on the bearing inner ring, acts as a slinger when this inner ring is rotating. Definite though extremely close clearances exist between the individual members so that nothing is added to the total bearing friction, the maker states.



The design is obtainable in a number of different variations—single seal, double seal, seal and shield combinations—and on either the maker's radial or wide inner ring bearings.

The same manufacturer has also announced ball bearings incorporating retainers made of oil impregnated bronze for specialized applications. Holding and slowly feeding sufficient oil to lubricate the bearing throughout its entire life, this new retainer is suitable for applications that are inaccessible or subject to subzero temperatures.

Also announced by the manufacturer is a process whereby



"NOISY? NO, SIR! AND SAFE AGAINST FIRE, TOO!"

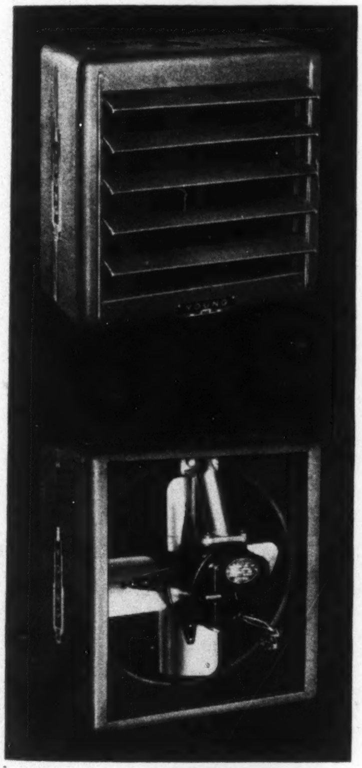
YOU won't have complaints about noise in ducts if you install J-M Airacoustic Sheets as linings. This new-type material does a permanent quieting job. And it gives clients an extra advantage they'll all appreciate . . . maximum protection against fire.

Such important advantages are possible because Airacoustic Sheets are basically mineral. They absorb more than 70% of all sounds in ducts. Their high moisture resistance and transverse strength assure low upkeep. Systems are safer, for Airacoustic Sheets do not support flame . . . effectively retard the spread of fire.

You can use J-M Airacoustic Sheets for lining any type of duct. They are light in weight, easy and economical to apply. Including them in all your installations helps assure a thoroughly satisfactory job every time. For details on this modern lining, write Johns-Manville, 22 East 40th Street, New York, N. Y.

JM Johns-Manville

AIRACOUSTIC SHEETS For Duct Linings



YOUNG

Heating & Cooling Products

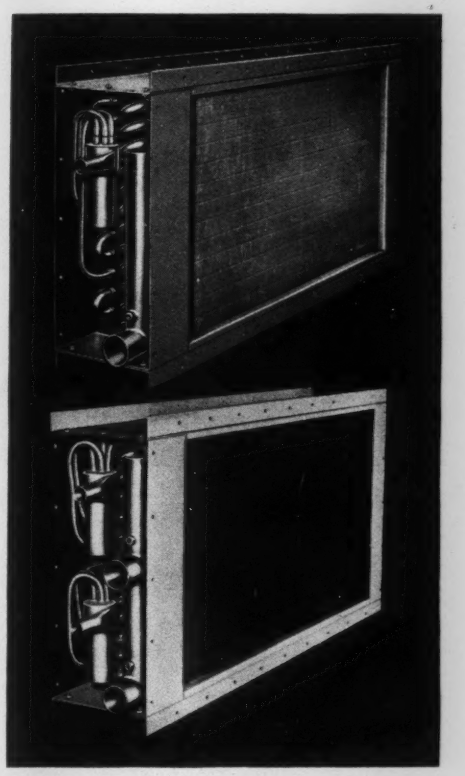
There are many architects and contractors who regularly specify Young products. Time has taught them it pays to install heating, cooling and air conditioning units which will perform efficiently over a period of years to the ultimate satisfaction of their users.

Young Streamaire unit heaters are available in 28 different sizes and capacities. They are generally accepted as a most economical way of heating industrial buildings.

The newly designed line of Young evaporators offers many features praiseworthy of consideration which cannot be procured elsewhere.

If you specify heating or cooling equipment there is a Young product to fill your need. If you have a heat transfer problem, a competent Young engineer will help you solve it without cost or obligation.

Write for Literature



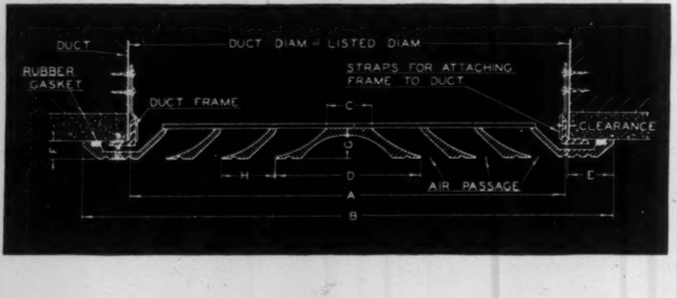
YOUNG RADIATOR COMPANY
RACINE WISCONSIN

Young Quality

AEROFUSE OUTLET

UNOBTRUSIVE EFFICIENCY

Designed primarily for functional efficiency, the Aerofuse Outlet does four things superlatively well. Provides 1. Maximum Air Mixture, 2. Rapid Temperature Equalization, 3. Perfect Air Distribution, 4. Total Elimination of Drafts. But, because of the great simplicity of design and the fact that it is practically flush with the ceiling line, the Aerofuse Outlet is unobtrusively attractive. It takes its place effectively in rooms decorated in any style whatsoever and never shouts its presence.



The Aerofuse Outlet is practically flush with the ceiling. In the sketch above, illustrating a cross section, the dimension "F" which is the extreme depth below the ceiling line, varies between $\frac{7}{16}$" and ½" depending on the size of the outlet.

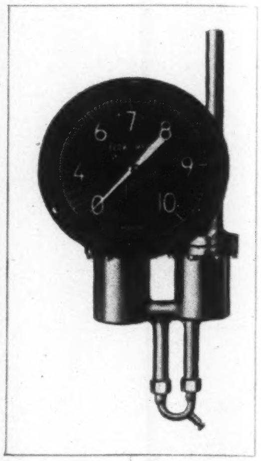
T & B

Tuttle & Bailey
Incorporated
NEW BRITAIN, CONN.
New York Chicago Philadelphia

exposed parts of ball bearing transmission units are chemical treated to resist corrosion without change in their physical pro erties or dimensions. The process involves formation of a oxide layer which penetrates into the surface of the metal, do not chip or peel, and is unaffected by temperature, it is stated.—Fafnir Bearing Co., 37 Booth St., New Britain, Conn.

Indicating Flow Meter

No. 1737—A new 6 in. dial type indicating flow meter has been announced in available ranges of 0-20 in. and 0-60 in. for working pressure up to 400 lb, and 0-100 in. for working pressure of 500 lb. Meters having a special test for 800 lb may also be obtained.

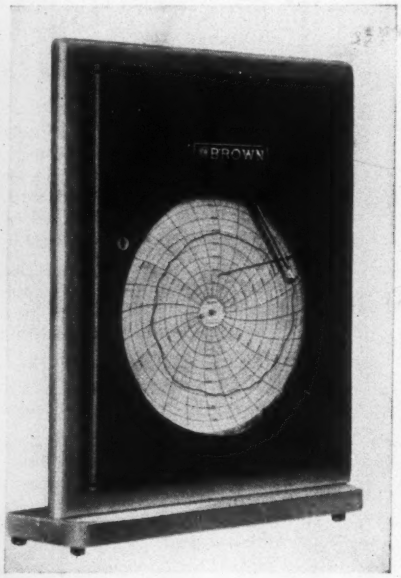


Patented check floats prevent loss of mercury from over-range or reverse flow, according to the maker, and emulsification of mercury is eliminated due to check valves which prevent oil from blowing through. Lubrication of the bearing is accomplished from the outside of the case, making it unnecessary to interrupt operation of the instrument.

The shaft and bearing surfaces are of stainless steel and stainless iron is used for the body.—Foxboro Co., 106 Neponset Ave., Foxboro, Mass.

Temperature and Pressure Instruments

No. 1738—An improved line of temperature and pressure recorders, indicators and controllers includes thermometers for a range from —40 F to 1200 F and pressure gages to 2500 lb per sq in. and for vacuum ranges of 10 in. of mercury and over, all types being offered in one, two or three pen models. The streamlined rectangular cases were styled by Henry Dreyfuss, designer of the "Twentieth Century Limited."



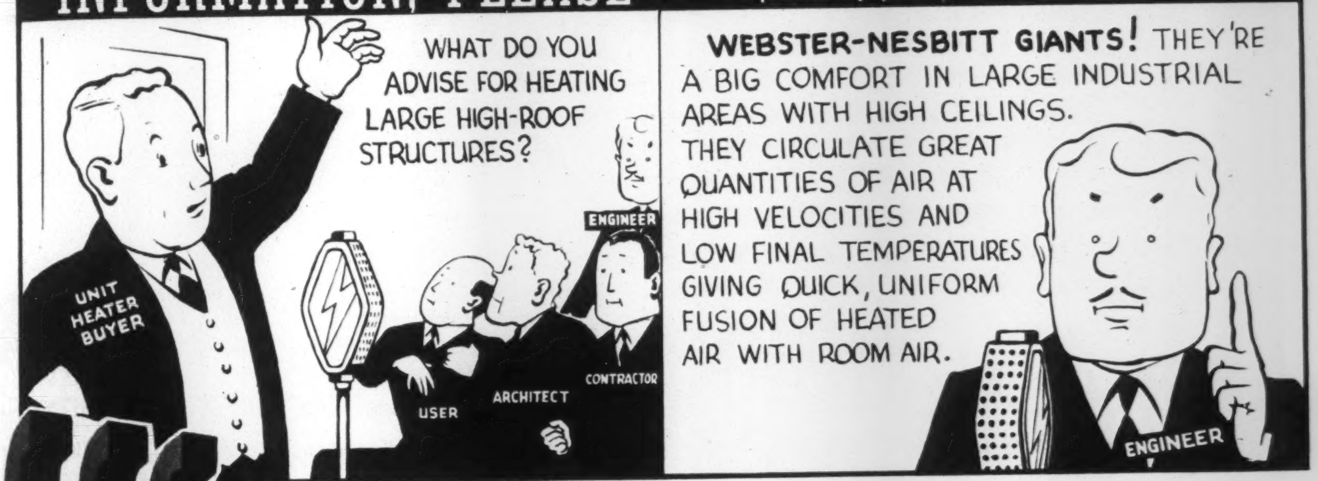
Features include—according to the maker—flat, spiral actuating elements having ample pen torque, a special safety link between actuating element and pen to protect the mechanism from damage if the pen is moved in either direction manually, and attachment of the chart to the driving mechanism by a tapered stud and tapered chart positioning stud. Charts, when renewed, are automatically in time as the tapered position stud is in effect the hour hand of the electric clock.—Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., 4534 Wayne Ave., Philadelphia, Pa.

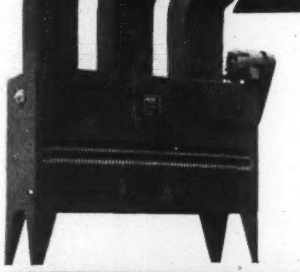
Pipe Vise with Stand

No. 1739—A vise complete with three legged stand has been added to the "Ridgid" line of pipe tools and offers several con-

"INFORMATION, PLEASE"

A typical unit heater buyer, having heard a Canada Dry program, questions a jury of experts about unit heaters. Title Used by Permission


WHAT DO YOU ADVISE FOR HEATING LARGE HIGH-ROOF STRUCTURES?
UNIT HEATER BUYER
ENGINEER
USER
ARCHITECT
CONTRACTOR
WEBSTER-NESBITT GIANTS! THEY'RE A BIG COMFORT IN LARGE INDUSTRIAL AREAS WITH HIGH CEILINGS. THEY CIRCULATE GREAT QUANTITIES OF AIR AT HIGH VELOCITIES AND LOW FINAL TEMPERATURES GIVING QUICK, UNIFORM FUSION OF HEATED AIR WITH ROOM AIR.
ENGINEER



Webster-Nesbitt Giant centrifugal-fan unit heaters are offered in a complete range of sizes and capacities, in floor-mounted, wall-mounted, ceiling-suspension, and inverted types • There are also the propeller-fan units, in 7 sizes of casing, for heating small and medium-size interiors • Series F unit heaters, in 4 sizes, are for small interiors where exceptionally quiet operation and neat appearance are important. **CATALOGS FREE ON REQUEST.**

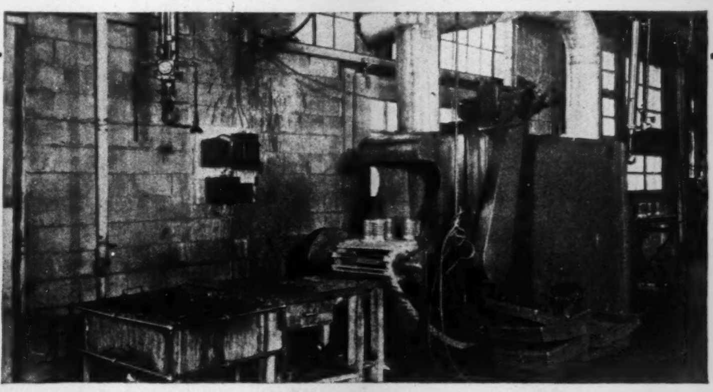
Webster Nesbitt

UNIT HEATERS

Address Nearest Webster Sales Office
Consult Telephone Directory

Manufactured by JOHN J. NESBITT, INC., Holmesburg, Philadelphia, Pa.
Distributed Exclusively in the U. S. A. by WARREN WEBSTER & COMPANY, Camden, N. J.

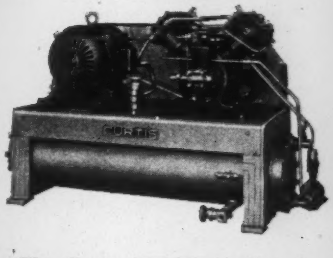
Why CURTIS is the Extra Value Line



Where CURTIS Parts Take a Bath!

This illustration shows the giant washing machine (capacity 325 g.p.m.) in the Curtis factory, where machined parts and castings pass through a multiple shower bath and are deluged with a boiling hot chemical solution which removes all grease, oil and metal particles. The heat imparted to the parts in washing assures thorough drying before the end of the process, following which all bright parts are dipped in an anti-rust bath before being used or placed in stock.

Thus another remarkable piece of equipment contributes to the extra value you'll always find in every Curtis product—with every manufacturing and finishing process performed in the complete Curtis plant under careful, accurate supervision. The result is the long life, exceptionally high efficiency and dependable performance characteristic of every Curtis condensing unit.



The Curtis 15 H.P. Shell and Tube Condensing Unit

CURTIS REFRIGERATING MACHINE CO.
1950 Kienlen Ave. St. Louis, Mo.

CURTIS REFRIGERATION AIR CONDITIONING AND COMMERCIAL

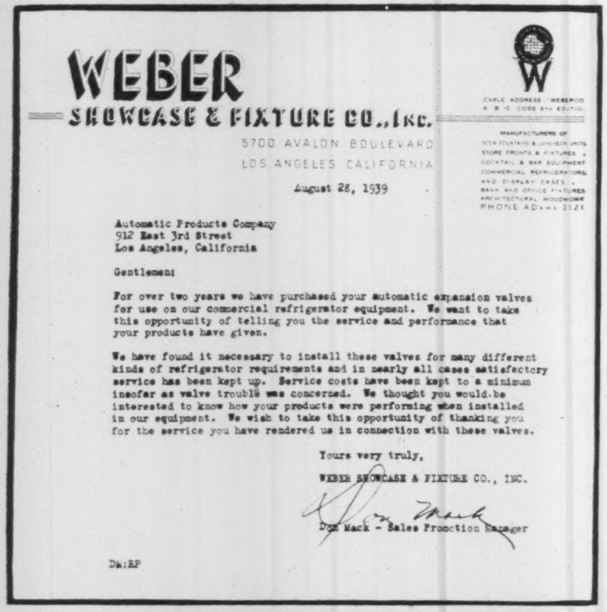
"Builders of Condensing Units Since 1922"

Division of Curtis Manufacturing Company

- **The Weber Showcase & Fixture Company, like many other famous manufacturers of commercial cabinets, has found A-P Valve Dependability the best assurance of service efficiency on all types of refrigeration.**

Service Engineers tell us that the most profitable Valve for any job is an A-P. It requires less service attention, and can be depended upon for accurate, leakproof, supersensitive refrigerant control under all conditions — trouble-free service that means satisfied customers.

SERVICE COSTS *kept* to a MINIMUM WITH AP VALVES



WEBER
SHOWCASE & FIXTURE CO., Inc.
5700 AVALON BOULEVARD
LOS ANGELES CALIFORNIA

CABLE ADDRESS WEBERCO
A B C CODE 5TH EDITION
MANUFACTURERS OF
SODA FOUNTAINS & LUNCHEON UNITS
STORE FRONTS & FIXTURES
COCKTAIL & BAR EQUIPMENT
COMMERCIAL REFRIGERATORS
AND DISPLAY CASES
BANK AND OFFICE FIXTURES
ARCHITECTURAL WOODWORK
PHONE ADams 3121

August 28, 1939

Automatic Products Company
912 East 3rd Street
Los Angeles, California

Gentlemen:

For over two years we have purchased your automatic expansion valves for use on our commercial refrigerator equipment. We want to take this opportunity of telling you the service and performance that your products have given.

We have found it necessary to install these valves for many different kinds of refrigerator requirements and in nearly all cases satisfactory service has been kept up. Service costs have been kept to a minimum insofar as valve trouble was concerned. We thought you would be interested to know how your products were performing when installed in our equipment. We wish to take this opportunity of thanking you for the service you have rendered us in connection with these valves.

Yours very truly,

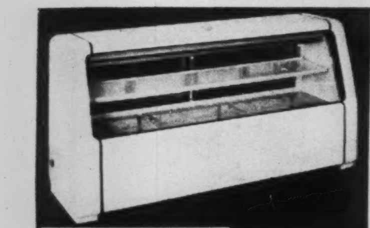
WEBER SHOWCASE & FIXTURE CO., INC.

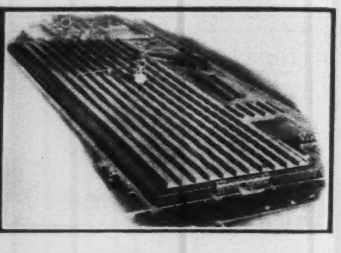
Don Mack

Don Mack - Sales Promotion Manager

DM:EP

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY — SECOND STREET
MILWAUKEE WISCONSIN





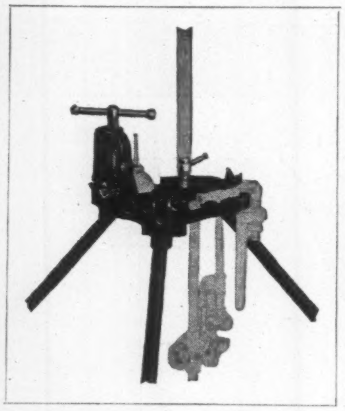
- **The new Weber Display Cabinet . . . A-P Valves have been standard equipment on these cases for over two years.**
- **Large, modern factory of Weber Showcase & Fixture Co., Inc., Los Angeles, California.**
- **A-P Model 205 Thermostatic Expansion Valve.**

Plan Now to See the Second Annual All-Industry Exhibition — Stevens Hotel, Chicago, January 15-18, 1940

- **Refrigeration Parts Jobbers, Who Recognize Quality, Stock AP Valves**

DEPENDABLE

THE BY-WORD FOR A-P VALVES

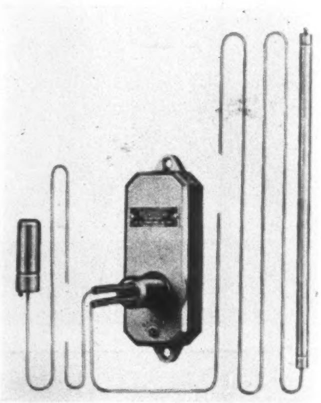


venient features, the mak states. The legs are hinge at the tray, fold togeth compactly and fasten with chain for convenient handling and carrying. It ha a pipe rest and three different size pipe benders, i equipped with an adjustabl screw with ceiling brace t hold the vise rigid while i use.

These "Tri-Stand" vises are available in 2½ in. yoke and 4 in. chain patterns.—Ridge Tool Co., Box 670, Elyria, Ohio.

Temperature Control for Hot Water Heating

No. 1740—A new differential temperature control for use with the manufacturer's forced circulation hot water heating system has been designed to balance indoor and outdoor temperatures to permit economy and comfort. One bulb is placed inside the building and one bulb outside the building. When heat is required the device operates the circulator which in turn operates the flow control valve.

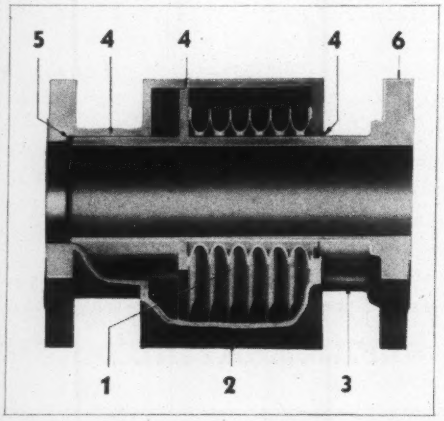


This heating method is offered for use in apartment houses and groups of industrial, tourist camp and other buildings.—H. A. Thrush & Co., Peru, Ind.

Packless Expansion Joint

No. 1741—The improved packless expansion joint shown here is of the U-ring type and is offered for steam and hot water lines, both low and high pressure and temperature service. The essential features of the joint, which has an expansion element operating on the principle of cold springing, are illustrated.

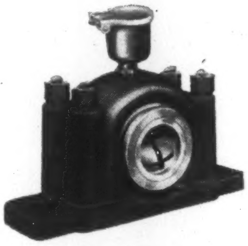
The expansion element (1) is a series of welded U-rings of corrosion resistant steel welded to the body (2) and the guide (4) on the movable sleeve (3) to form a permanent seal between the stationary body and the movable sleeve. The element is compressed axially or cold sprung one-half the total traverse for installation in the cold line. As the line expands, compression in the element is relieved and it passes through the neutral position and into tension for the remaining half of the traverse.



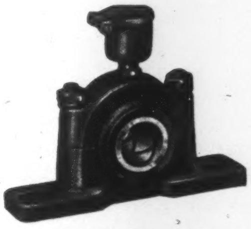
The joint is guided at three points (4) and a limit stop (5) prevents overtravel. It is furnished with flanged ends (6) or with beveled ends for welding for pressures to 300 lb with traverses of 1, 2, 3 and 4 in.—American District Steam Co., Bryant St., North Tonawanda, N. Y.

Randall

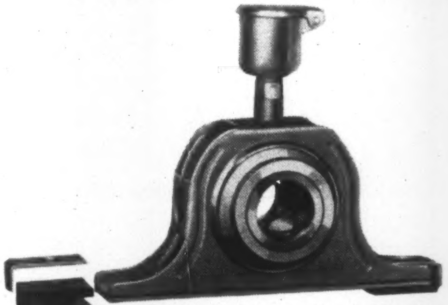
A NAME FOR PILLOW BLOCK EFFICIENCY



Randall Universal Pillow Block



Randall Standard Pillow Block



Randall One-Piece Steel Housing Pillow Block showing vibration-isolating rubber grommets.

Randall's efficient pillow blocks meet the most exacting engineering requirements. Their long life and continuous satisfactory operation in the field demonstrate Randall's carefully engineered design and precision workmanship.

Their unique patented design is simple. They are rugged and dependable. Requiring but a minimum of attention over long periods due to their unusually large oil capacity, they are self-aligning, self-lubricating, and operate with a minimum running torque. They are quiet in operation.

Randall's experience and unsurpassed performance have influenced most manufacturers of heating and air conditioning equipment to standardize on Randall units.

Write for catalog describing in detail the complete Randall line.

Representatives carrying stocks.

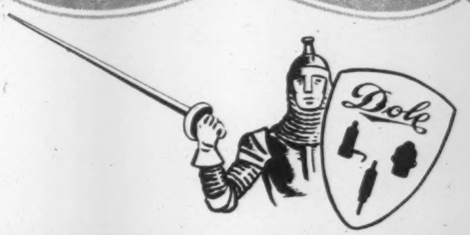
Tek Bearing Co.
177 Lafayette
New York City

American Stock Gear Co.
100 St. Clair Ave., N. W.
Cleveland, Ohio

Salt Lake Hardware Co.
Salt Lake City, Utah

C. W. Marwedel
San Francisco, Cal.

Randall GRAPHITE PRODUCTS CORP.
Dept. 1210 609 W. Lake St., Chicago, Ill.



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● A strong line of star performers is as good protection in the heating and ventilating field as on the football field. That's how the 1940 All-Star Line of Dole Valves shields the men who specify or use them on their jobs—preventing losses—holding their gains.

Just by keeping an eye on performance, Dole engineers have known what the new line, evolving out of the old, should include. It is built for *star performance* and based solidly on all that proved best in previous models. It is significant that no really radical changes were necessary—rather we added important refinements.

Careful planning has given you a Dole Valve to bring the best profit out of conditions as you find them—on the job—or over the counter. And, *precision engineering* is our way of making the profits you bank STAY YOURS.

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Air and Vacuum VALVES

Dole 1 A Vari-Vent—spectacular performer in balancing radiators of automatically fired systems.

Dole 33 Angle Air Valve—a fast mover and priced to win.

Dole 3 Air Valve—For general use on radiators of gravity systems—Good looking, attractively packaged—Value at a glance and good for years of service.

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HUSSEY *Pure Lake* **COPPER**

Fortified and endowed by Nature to ideally withstand the most severe corrosive conditions, Hussey Pure Lake Copper is a "natural" for Air Washers, Blowers, Coils, Ducts, Tanks, and other similar units required in modern air conditioning systems—where permanence of installation and trouble free service are of paramount importance. That is why Hussey Pure Lake Copper enjoys such rating among air conditioning engineers and contractors throughout the industry,—why it always pays to insist on Hussey Pure Lake Copper—the standard of quality for more than 90 years.

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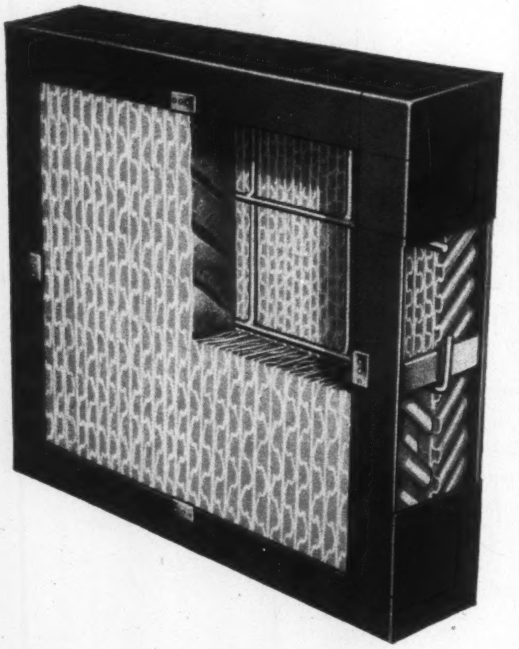
DETROIT AIR FILTER



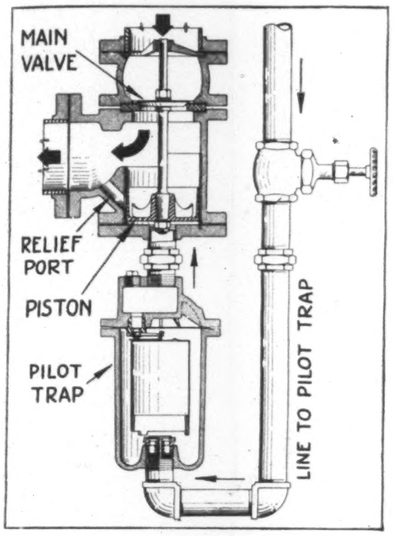
● The design and the choice of materials for the Improved Detroit Filter provide high dust removal capacity and unusually long service life. Air resistance, which is extremely low initially, increases only very gradually during the service life of the filter. Thus the Detroit Filter which carries a low initial cost is one of the most economical units available.

Write for Bulletin No. 187

DETROIT LUBRICATOR COMPANY
General Offices: DETROIT, MICHIGAN
Canadian Representatives: RAILWAY AND ENGINEERING SPECIALTIES LIMITED
Montreal • Toronto • Winnipeg

Giant Steam Trap

No. 1742—A giant steam trap with 6 in. pipe connections and continuous flow capacity for 300,000 lb per hr of water at 50 lb pressure has been announced. Built first for draining evaporators in sugar refineries, it is now offered for automatic drainage for large steam purifiers, separators, flash tanks, heat exchangers, continuous blow down systems, multiple effect evaporators, etc.

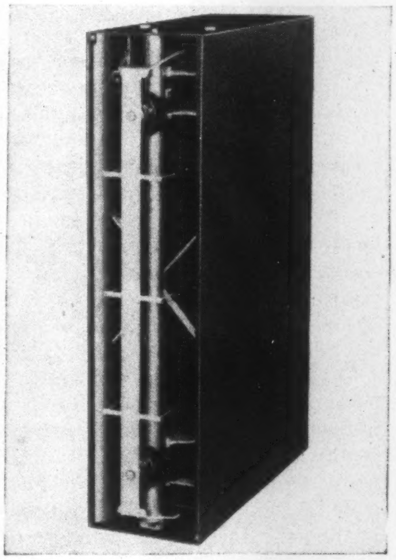


The unit consists of a large inverted bucket type pilot trap and a piston operated main valve, the main valve assembly being installed as an elbow in the drain line. The pilot trap is connected to the drain line at a point above the main valve assembly, and the main valve is kept sealed with water in this manner.

The operating cycle starts with flow of condensate to the pilot trap which discharges against the piston of the main valve, forcing the piston upward until the relief port is uncovered. Because the piston head area is greater than the main valve cross section area, it is possible to open the main valve against any pressure. Upward movement of the piston is checked by using the piston skirt to cut down the area of the main outlet port. Snap action closing takes place when steam, instead of water, starts coming into the pilot trap and causes it to close. Use of the inverted bucket type pilot trap makes the unit non-air binding, states the maker.—Armstrong Machine Works, 874 Maple St., Three Rivers, Mich.

Electrostatic Air Cleaning Equipment

No. 1743—A new line of redesigned and improved "Precipitron" electrostatic air cleaning equipment for commercial and industrial use has two sizes of cells which have been adopted as standard. One has an effective cross section 8 in. by 18 in. with a cleaning capacity of 375 cfm of air. The other, with a capacity twice as great, is 8 in. by 36 in. From the two standard units, an air cleaning system for any given physical layout may be constructed.



By the Bureau of Standards' "blackness test" the larger cell has a guaranteed efficiency of 90 per cent at 600 cfm and 85 per cent at 750 cfm; the smaller is 90 per cent efficient at 300 cfm and 85 per cent at 375 cfm.

Power packs are available in two standard sizes. Both are similar in construction, consisting of a high reactance transformer, rectifier tubes, a capacitor, an indicating sys-

500 SARCO STEAM TRAPS

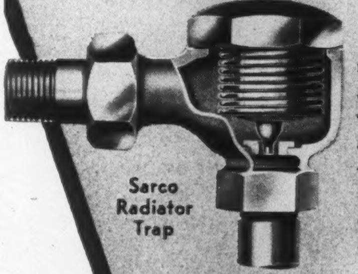
IN SERVICE 10 YEARS

Only 25 Replacements

"In ten years we have replaced only 25 trap elements on our heating system. It works perfectly and always has. Furthermore, the Sarco Hook-up with 8" vacuum on supply and 12" on the returns introduced steam savings that have paid for the equipment many times over.

"Thousands of Sarco Steam Traps are used in large hospitals, office and public buildings in Detroit—many of them installed years before ours—and I have never heard anyone complain. You can't go wrong with Sarco."

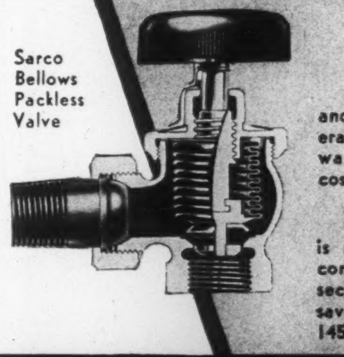
Emil Jensen, Chief Engineer
Detroit "Times"



Sarco Radiator Trap

THE SARCO BELLOWS

shown at left is the actuating element that provides quick and accurate opening and closing and that has demonstrated its ability to perform years after its moderate first cost has been earned by the savings.



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and hot water blenders in several forms provide better hot water service with minimum costs.

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It pays to use multi-speed motors wherever possible. First, they are far more efficient in operation. Second, they cost considerably less.

HOWELL Multi-speeds are available as 2, 3 or 4-speed motors . . . variable horsepower, variable torque . . . sizes up to 150 H.P. in standard frames, or with totally-enclosed dust-proof or moisture-proof housings.

Every day HOWELL saves somebody money by intelligent motor selection—by applying the RIGHT motors to the RIGHT jobs.

What are your drive problems? You, too, may find HOWELL the economy answer to your motor needs. Consult your telephone directory for address of our local representative, or write us.

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HOWELL Quietness Tests are made in a sound-proof laboratory; motor operating at full speed; results read in decibels. To pass this exacting check-up, HOWELL Air Conditioning Motors MUST PROVE quiet-running to the Nth degree.

OWELL RED BAND MOTORS
Make Good on Hard Jobs

OWELL ELECTRIC MOTORS COMPANY
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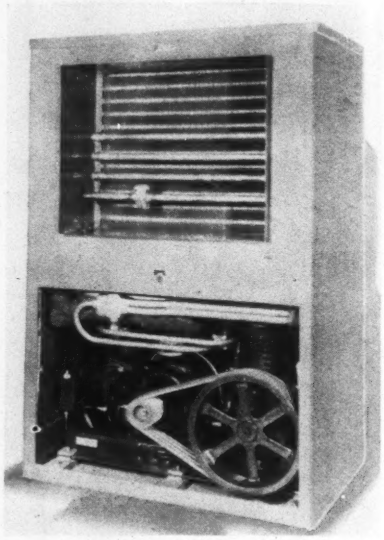
tem, and a cabinet to house the parts. Both types operate n 115 volt, single phase a-c lines.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Booster Type Conditioner

No. 1744—A booster type air conditioner for installation as an integral part of the duct is illustrated here. It was originally developed for installation in an industrial air conditioning system where more cooling was needed than a certain duct was able to deliver at times. The lengths of pipe extending across the face of the finned coil, which may be seen in the illustration, are provided for superheating the suction gas before it reaches the compressor.



If the unit cannot be placed right in the duct itself, a bypass can be arranged to send part or all of the air through the coils of the booster.—Frick Co., W. Main St., Waynesboro, Pa.

Acid Resisting Pump

No. 1745—A new pump made of stainless steel and mounted on a vitreous porcelain enameled stand has been developed and is available in three sizes ranging from 140 to 360 gph.

Features include a new type of fan which pulls the air up through the motor, self-aligning bearings, moisture resisting stator coils and a tube outlet plated with block tin inside and out.—Air-O-Line Co., Dallas, Texas.

Book Reviews

Wrought Iron

["Wrought Iron—Its Manufacture, Characteristics and Applications" by James Aston and Edward B. Story, consulting metallurgist and chief metallurgist, respectively, A. M. Byers Co. 2nd ed. 1939. vi + 97 pp., 6x9 in., clothbound. Published by A. M. Byers Co., Clark Bldg., Pittsburgh, Pa. Price, $1.00—available to readers of HEATING, PIPING AND AIR CONDITIONING gratis upon request on business stationery to A. M. Byers Co.]

Published first in 1936 as a reference work for engineering organizations, this book has become a standard engineering text in more than 100 technical schools and colleges and over 50,000 copies have been distributed. The second edition has been completely rewritten and several chapters have been added; numerous photographs are included to illustrate the various phases of the subject.

Chapters are given on wrought iron manufacture prior to 1850, modern developments and research in manufacture, present day method for manufacturing, introduction of other ferrous metals, quality standards, specifications and durability testing, characteristics, forging and bending, welding, principal applications, and material selection. The book concludes with a glossary of terms relating to wrought iron manufacture and products.

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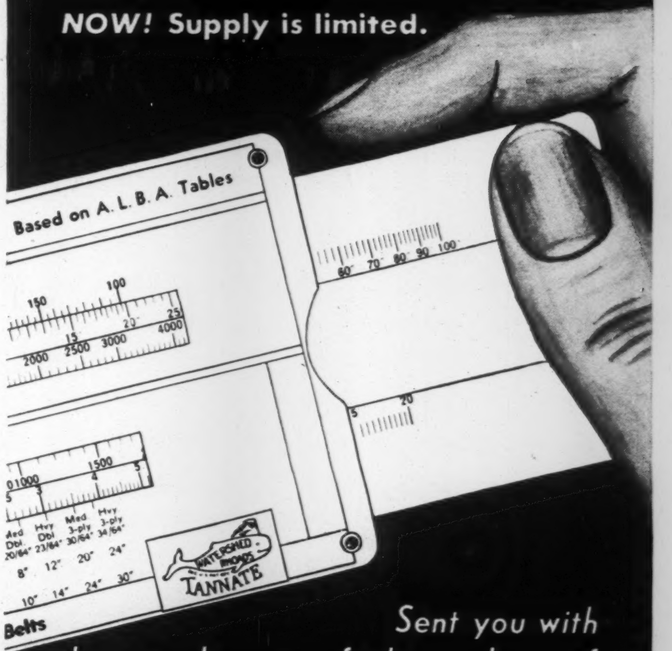

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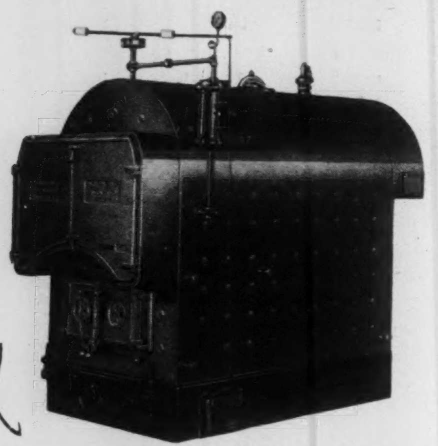
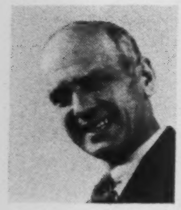


The Welded Steel Burnham. Made in 19 sizes, ranging in capacities from 1,800 to 42,500 sq. ft.

Tells Why This Steel Burnham Is Like a Camel



One of the things I like most about a camel, is yer can't throw any dust in its eyes.

Fur more centuries than you and I can remember, whole strings of 'em has been trekking across the desert kicking up no end o' dust. And what they don't kick up, the wind does.

But Mr. Camel just keeps on blinking at the dust and humping along.

Seems as how that's exactly what our welded steel boiler has been a doing. It's just been humping along until here lately it has gone clean across the country and landed itself in a passel of schools in California.

It landed there, because it's made both on a *specification* and a *reputation*. The latter has a build up of close to three quarters of a century. Which, wouldn't you say, is about enough fur even the most pernickety of you engineering fellers?

HANK HINDLE

See our Exhibit, Space No. 122, 6th International Heating & Ventilating Exposition, Lakeside Hall, Cleveland, Ohio —January 22nd to 26th, 1940.

BURNHAM BOILER CORPORATION

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Burnham Boiler

Patent Fundamentals

["Patent Fundamentals," by Adelbert Schapp, Schapp and Cole, Patent Attorneys. 1st ed. 1939. 176 pp., 5½x8½ in., cloth-bound. Published by the Industrial Press, 148 Lafayette St., New York, N. Y. Price, $2.00.]

This book explains in non-technical language and demonstrates by practical examples the underlying principles of invention, procedure in obtaining patent protection, drafting effective claims, making assignments, issuing licenses, etc.—in brief, how to protect both invention and inventor. Information is also included on trade names and copyrights.

Chapters are included on why inventors fail in securing protection, classes of patents and patentable developments, preliminary safeguards, making patent claims cover essential principles, interferences between different inventions, assignment of interests and licenses granting right to exploit inventions, trademarks and copyright protection, and extent of application.

Booklets, Reports and Papers

Symposium on Insulating Materials

The American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., has published a 125 p. publication including the papers and discussion which formed the symposium on thermal insulating materials held at the Columbus regional meeting March 8, 1939. Paper bound copies are available at $1.25, and clothbound at $1.50, from ASTM headquarters.

Of the four technical papers comprising the symposium, the first on Factors Influencing the Thermal Conductivity of Materials, by J. B. Austin, gives a discussion of the properties of materials which affect thermal conductivity. Other fundamental principles of heat flow are covered. H. H. Rinehart, in A Discussion of Test Methods for Determining the Physical Properties of Thermal Insulation, covers many problems being studied in the effort to develop proper standards for gaging the acceptability of materials. E. T. Cope and W. F. Kinney, in their paper on One Consumer's Problems in Selecting Thermal Insulation, present some of the difficulties encountered in purchasing and using materials and which it is expected the work of the ASTM may correct.

F. C. Houghten, Carl Gutberlet, and Albert A. Rosenberg of the research laboratory of the American Society of Heating and Ventilating Engineers, in their paper on The Effect of Solar Radiation on the Heat Transmission Through Walls, deal with a somewhat unusual phase of the insulation problem. Whereas we are usually concerned with heat flow through insulation under steady state conditions, the heat flow through the walls of buildings under the influence of solar radiation is decidedly cyclic. Therefor the thermal capacity of the wall and of the insulation is an important factor. The fundamental principles are discussed and actual data are presented.

Material Specifications for Pumping Equipment

The petroleum market group of the Hydraulic Institute, 90 West St., New York, N. Y., has recently issued a 16 p. pamphlet on material specifications for pumping equipment. This is part of the standards of the institute and the price of the pamphlet is 25c.

It includes material specifications for gray-iron castings, nickel-base austenitic cast iron, carbon and alloy steel castings, bronze castings, cast nickel copper alloy, and heavy duty bolting material and nuts.

The specifications have been reviewed by several refinery engineers and have met with their approval. The intention is to put them into general use through the medium of this pamphlet with the hope that they may further obtain approval of the majority of users of this type of equipment.

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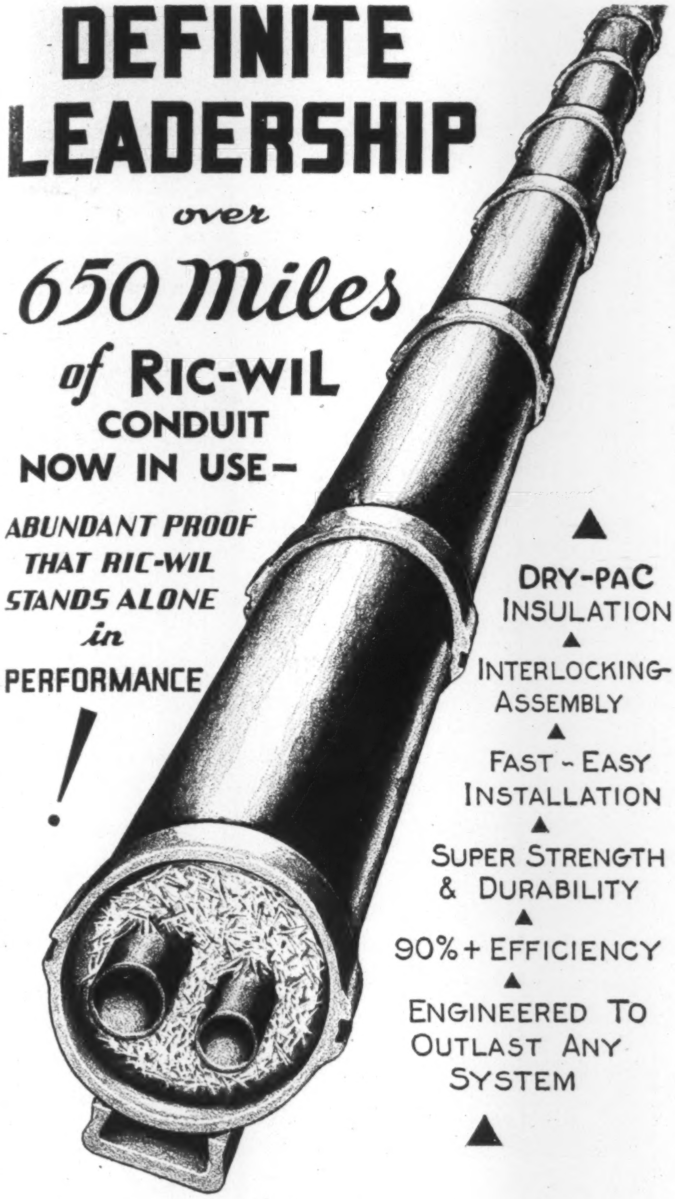

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The Conduit for
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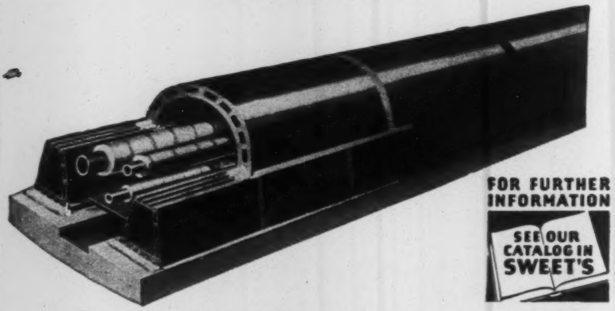

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Conventions and Expositions

American Society of Mechanical Engineers: Annual meeting, December 4-8, The Bellevue-Stratford, Philadelphia, Pa. Headquarters office, 29 W. 39th St., New York, N. Y. To include discussion on heating and ventilating the modern airplane, a session on heat transfer, and a symposium on piping design.

Louisiana Engineering Society: Annual meeting, January 12-13, St. Charles Hotel, New Orleans, La. Headquarters office, Suite 422, St. Charles Hotel.

Refrigeration Service Engineers Society: Annual convention, January 15-18, Chicago, Ill. Secretary, H. T. McDermott, 433 N. Waller Ave., Chicago, Ill.

Refrigeration and Air Conditioning Exhibition: January 15-18, Stevens Hotel, Chicago, Ill. Exhibition Manager, R. M. McClure, 111 W. Washington St., Chicago, Ill.

American Society of Refrigerating Engineers: Annual meeting, January 17-19, Blackstone Hotel, Chicago, Ill. Secretary, D. L. Fiske, 37 W. 39th St., New York, N. Y. Program includes discussions on water treatment in air conditioning, pressure drop in small pipes, industrial refrigeration, and will celebrate 35th anniversary of founding of ASRE.

American Society of Heating and Ventilating Engineers: Annual meeting, January 22-25, Hotel Statler, Cleveland, Ohio. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Sixth International Heating and Ventilating Exposition: January 22-26, Lakeside Hall, Cleveland, Ohio. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y.

National Warm Air Heating and Air Conditioning Association: Annual convention, January 22-24, Hotel Hollenden, Cleveland, Ohio. Managing Director, Allen W. Williams, 5 E. Long St., Columbus, Ohio.

Heating, Piping and Air Conditioning Contractors National Association: Annual convention, May 27-30, Hotel Pennsylvania, New York, N. Y. Secretary, Joseph C. Fitts, 1250 Sixth Ave., New York, N. Y.

Recent Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 126. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 3367. AIR CONDITIONING USES: Industrial Training Institute, 2130 W. Lawrence Ave., Chicago, Ill. Looseleaf booklet (Study No. 63) listing 355 applications of air conditioning for comfort and in industry, based on information collected and compiled by the research department of the institute.

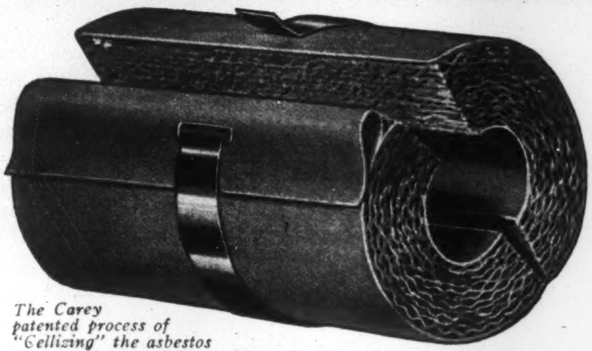
No. 3368. AIR DISTRIBUTION: Anemostat Corp. of America, 10 E. 39th St., New York, N. Y. Catalog on the "Anemostat" for use in railroads, comprising a short treatise on draftless air distribution for railroad cars with typical duct layouts for coaches, smoking, cafe and parlor cars, including designs of special transportation "Anemostats" and "Anemostat" and light combinations, with volume and velocity tables.

No. 3369. BLOWERS AND FANS: International Engineering, Inc., 1145 Bolander Ave., Dayton, Ohio. 20 p. catalog (71) on blowers and fans for mills and industrial plants, including information on blast coolers, duct boosters, fan guards, pent houses, shutters, stack fans and extended shaft fans.

No. 3370. CIRCULATORS: Everite Pump & Mfg. Co., Inc., Lancaster, Pa. 4 p. bulletin on redesigned circulator for hot water heating systems, illustrating and describing features and giving capacities. Accessories for circulating control systems are also shown.

Careycel
ASBESTOS INSULATION

PIPE COVERINGS and BLOCKS



The Carey patented process of "Cellizing" the asbestos sheets makes possible the high efficiency of Careycel.

CAREYCEL—the patented, INDENTED (not corrugated) Asbestos Insulation—is designed specially to insulate pipes, domestic and industrial boilers, water heaters, ovens and other apparatus carrying temperatures up to 300°F.

CUTS HEAT LOSSES 30%

Heat loss through Careycel, according to impartial Mellon Institute tests, is 30% less than through an equal thickness of aircell (coarse corrugated) asbestos insulation. Shrinkage is negligible—only 0.05%. Provides smoother outer surface. Careycel may be obtained in the form of pipe covering; sheets and blocks, either flat or curved to any desired radius. For complete data on this ultra-modern insulation, write Dept. 25.

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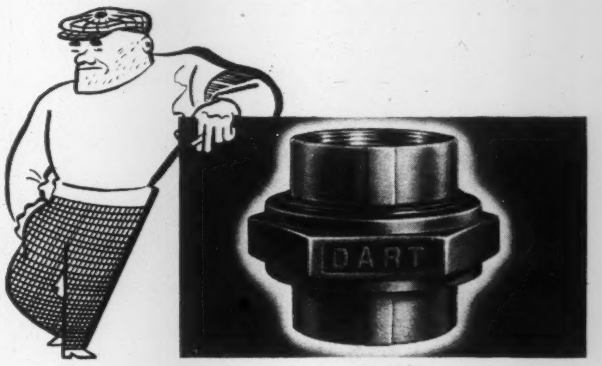

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There are plenty of sound reasons for Dart's ability to "take it" in tough service. Dart bodies and nuts, for example, are made from high test, air furnace malleable iron, carefully selected for its resistance to stretch and distortion. This means extra resistance to pipe strains, prevents scored threads, insures tight joints REPEATEDLY. . . . So when operating conditions are tough, standardize on Darts. Send for one to try.

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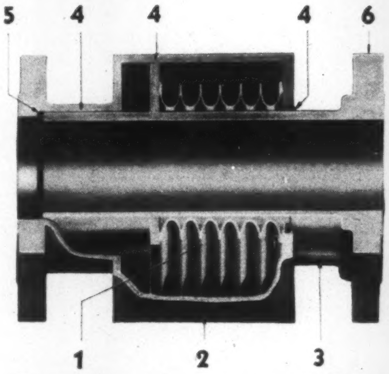
With PACKLESS FLEXIBLE STEEL ELEMENT



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Write for new Bulletin No. 35-50A.

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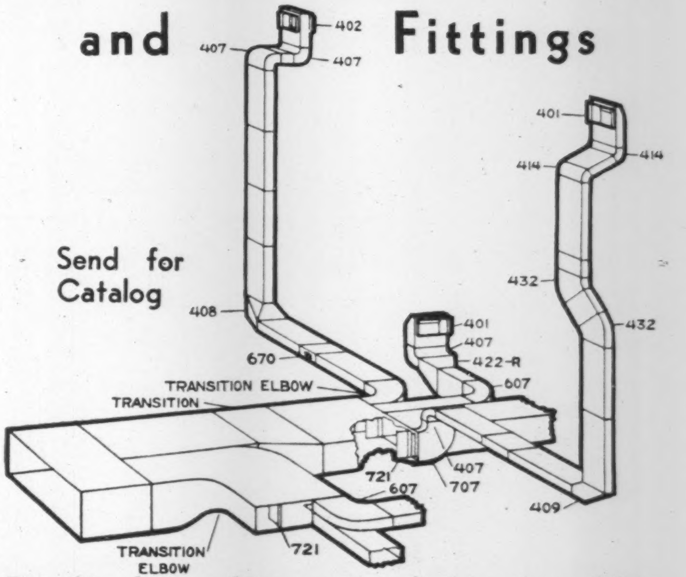

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SPECIALTY CO., INC.
WATERBURY, CONNECTICUT

No. 3371. DIRECT WARM AIR HEATING SYSTEMS: Lee Engineering Co., Youngstown, Ohio. 16 p. bulletin on direct warm air heating systems for combined heating and ventilation in warehouses, garages and other industrial buildings, discussing advantages, illustrating installations and listing the data required for estimating.

No. 3372. DRIVES: American Leather Belting Association, 100 Gold St., New York, N. Y. Data book on automatic tension control, short center, pivoted motor, leather belt drives, produced through the coöperation of 46 manufacturers of leather belting and motor bases, with information and supporting data on efficiency of such drives, test results and a wealth of information on selection, prices, etc. The edition is limited but may be obtained by readers on request to the association, leather belting companies or manufacturers of pivoted motor bases.

No. 3373. DRIVES: Congress Tool & Die Co., 9030 Lumpkin Ave., Detroit, Mich. 8 p. catalog (139) showing line of v-belt pulleys and flexible couplings, as well as step cone pulleys, crown face pulleys and variable speed pulleys.

No. 3374. DRIVES: Dayton Rubber Mfg. Co., 2345 W. Riverview Ave., Dayton, Ohio. 40 p. catalog (150) of v-belt drives for fractional horsepower service, giving general information, data on selection, drive tables with various belts, and other data.

No. 3375. ELECTRICAL EQUIPMENT: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 59 p. "Quick Selector" catalog designed to aid the user in selecting the right equipment for a motor or lighting circuit. Information is included on safety switches, "Nofuze" circuit breakers and multibreakers, panel boards, motor control devices, and motors.

No. 3376. EXHAUST FANS AND VENTILATORS: Propellair, Inc., 1345 Lagonda Ave., Springfield, Ohio. 20 p. bulletin on improved air foil propeller exhaust fans and ventilators, with information on code tests, types of fans, examples of applications, rating tables, and construction and performance data.

No. 3377. FINNED COILS: Sam Kennard, Inc., 3333-3335 Market St., St. Louis, Mo. Looseleaf bulletin on finned coils for air conditioning, including types for cooling by direct expansion and cold water, and for heating by steam and hot water.

No. 3378. INDUSTRIAL THERMOMETERS: C. J. Tagliabue Mfg. Co., 540 Park Ave., New York, N. Y. 24 p. catalog (1125C) on "Tag" industrial thermometers, including miscellaneous metal and wood back thermometers and hygrometers, U gages, mercurial vacuum gages and mercurial barometers.

No. 3379. LEAD, TIN AND OTHER PRODUCTS: Eagle-Picher Lead Co., Temple Bar Bldg., Cincinnati, Ohio. 36 p. catalog (M) on various products for industry including lead pipe, tin pipe, solders, tubing, sheet lead, tellurium lead, zinc and other products.

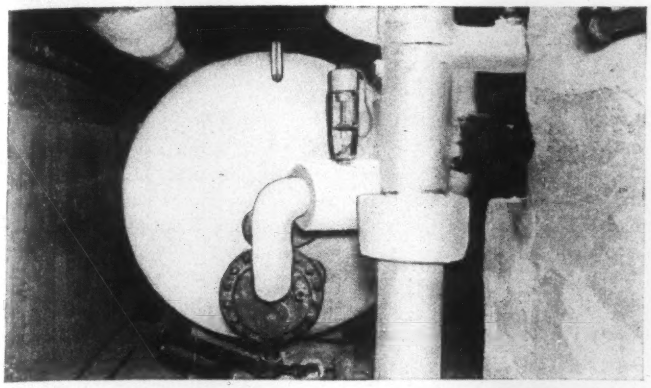
No. 3380. LUBRICATION: The Texas Co., 135 E. 42nd St., New York, N. Y. Issue of "Lubrication" (Vol 25, No. 10) devoted to lubrication problems created by the modern diesel. Also, issue of the same publication (Vol. 25, No. 11) devoted to lubrication problems in connection with power transmission and speed reduction.

No. 3381. MOTORS: Emerson Electric Mfg. Co., 1847 Washington Ave., St. Louis, Mo. 4 p. folder (X-3558) briefly describing and picturing complete line of stock motors in sizes 5 hp and smaller.

No. 3382. MOTORS: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Leaflet (F-8493) describing end mounting motors in both complete and skeleton types for air filters, blowers and other applications requiring similar style of mounting.

No. 3383. PAINTING GALVANIZED IRON: American Chemical Paint Co., Ambler, Pa. 4 p. bulletin (7-2-3) explaining nature and use of "Lithoform" for making paint stick to galvanized iron or other zinc or cadmium surfaces.

No. 3384. PIPE COVERING PROTECTORS: Grant Wilson, Inc., 4115 W. Taylor St., Chicago, Ill. 4 p. bulletin and contractors price sheet on "Cheney-Royal" pipe covering protectors



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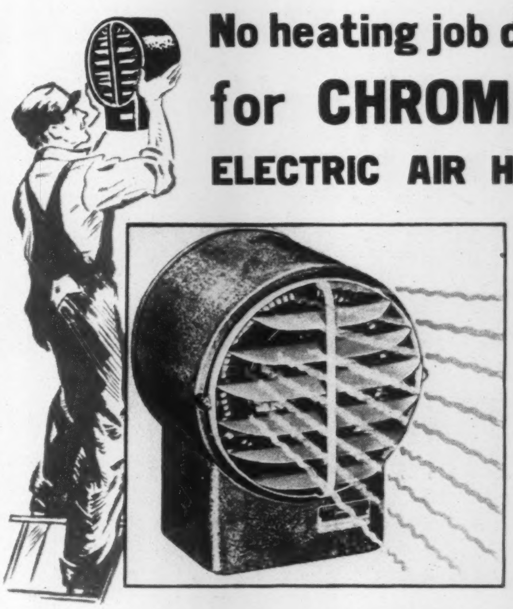

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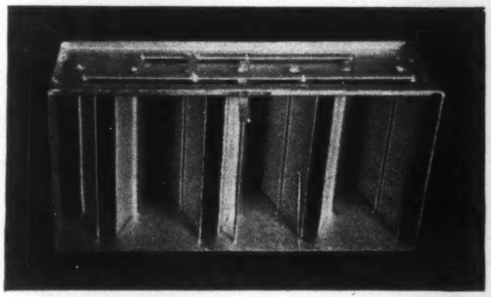

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No. 3385. PIPING IDENTIFICATION: Jones & Laughl Steel Corp., Third and Ross Sts., Pittsburgh, Pa. Convenie chart showing colors used in standard classification of piping systems to identify fire protective systems and piping carryi dangerous or valuable materials. It is based on the Recommended American Practice Scheme for the Identification of Piping Systems.

No. 3386. PUMPS: Worthington Pump & Machinery Corp., Harrison, N. J. 8 p. bulletin (W-321-B14) announcing the balanced "Monobloc" pumping unit with rating table, dimensions, and information on constructional features. Also 4 p. bulletin (W-322-B1D) on two stage balanced "Monobloc" centrifugal pumps.

No. 3387. REFRIGERATION UNITS: Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J. 6 p. bulletin (C-1100-B6) on low pressure refrigeration units, ¼ to 25 hp, for "Freon-12" or methyl chloride, giving a thorough description of features and advantages. Also a similar 6 p. bulletin (C-1100-B7) on 75 to 125 hp refrigeration units for "Freon-12."

No. 3388. RELAYS, TIMING DEVICES AND THERMOSTATS: Struthers Dunn, Inc., 1315 Cherry St., Philadelphia, Pa. 32 p. catalog of electrical control devices containing new items, new prices and other information on relays, timing devices and thermostats.

No. 3389. SHEARS: Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. 16 p. bulletin (80-C) on foot operated squaring shears and hand operated rotary shears for sheet metal shops.

No. 3390. VALVES: Lunkenheimer Co., Waverly and Beekman Sts., Cincinnati, Ohio. 136 p. catalog (78) illustrating, describing and listing the manufacturer's complete line of bronze, iron and steel valves; boiler mountings; lubricating devices; oil and grease cups; whistles; cocks; fittings; etc.

No. 3391. WELDERS: Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York, N. Y. 16 p. bulletin on "Hornet" electric arc welding generators, giving complete details and technical data on the machine. A feature of the bulletin is its informal analysis of the arc welder's problems, followed by a discussion of the way this analysis was applied to the design of these units.

No. 3392. WELDING ELECTRODES: McKay Co., McKay Bldg., 1005 Liberty Ave., Pittsburgh, Pa. 24 p. booklet (E-16) on shielded arc welding electrodes, containing the 1939 joint tentative specifications for iron and steel arc welding electrodes of the American Welding Society and the American Society for Testing Materials. Information on selection of different mild steel electrodes according to the work is given, with comparative tables and charts.

HEATING, PIPING AND AIR CONDITIONING,
6 N. Michigan Ave., Chicago, Ill. [12-39]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Recent Trade Literature." (Circle the numbers in which you are interested):

1733	1734	1735	1736	1737	1738	1739
1740	1741	1742	1743	1744	1745	
3367	3368	3369	3370	3371	3372	3373
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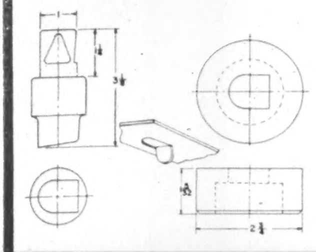

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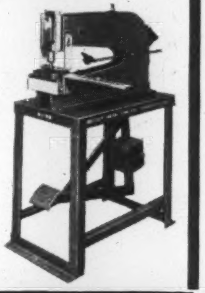

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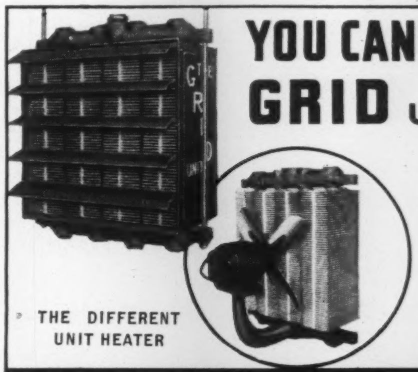

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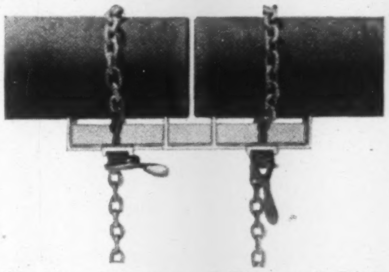

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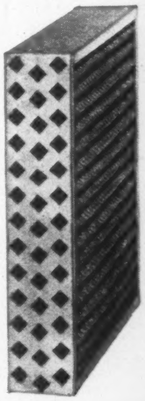

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The New York Blower Company has openings in certain territories, within a 500 mile radius of La Porte, Indiana,—for sucecssful and experienced representatives,—for the sale of the full line of Fan and Blower Products of this old and well established blower company. This includes sales representation for Fans and Blowers, Industrial Unit Heaters, and Classroom Unit Ventilators. For further information address Sales Manager, The New York Blower Co., 3200 Shields Ave., Chicago, Ill.

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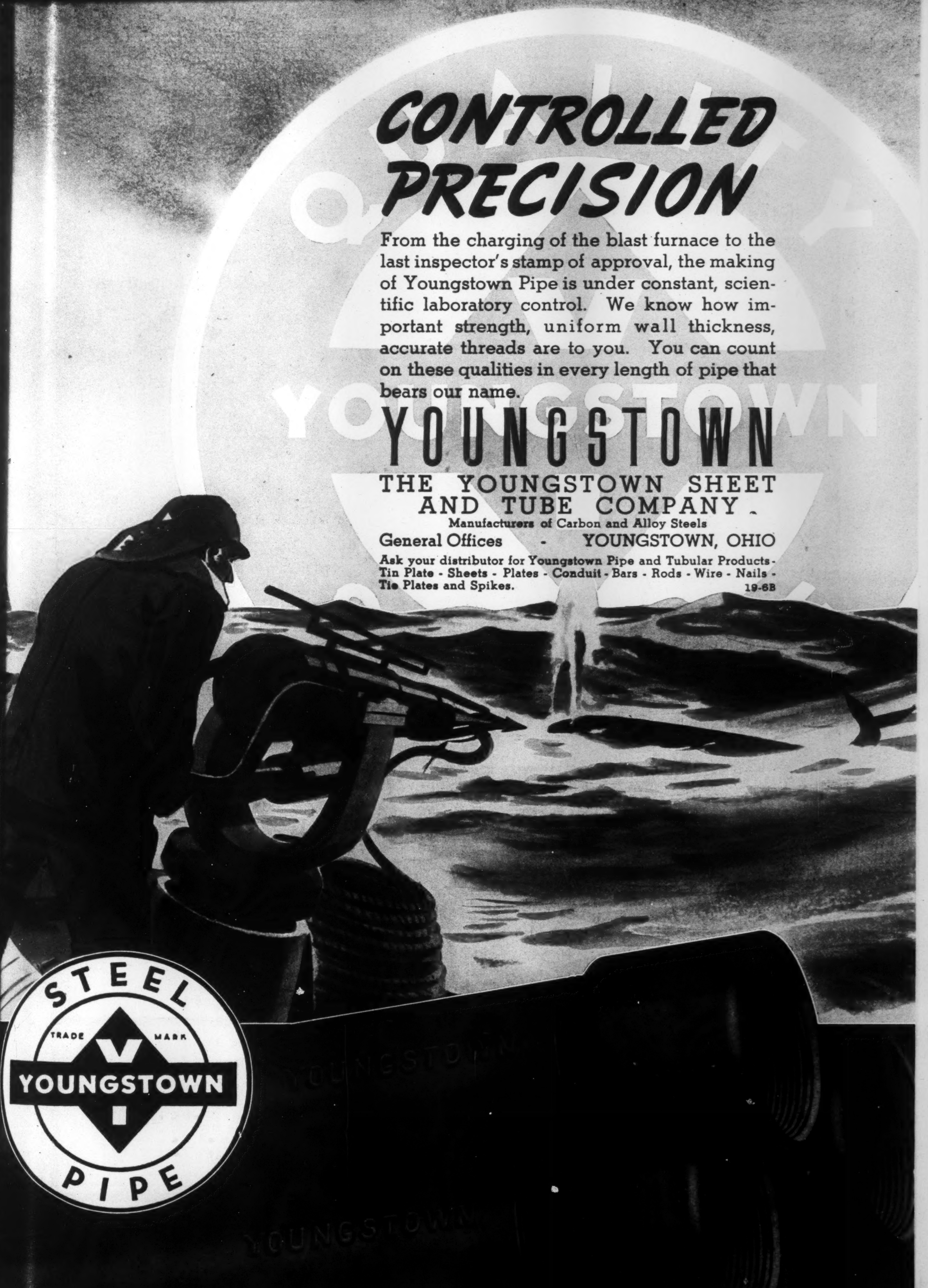
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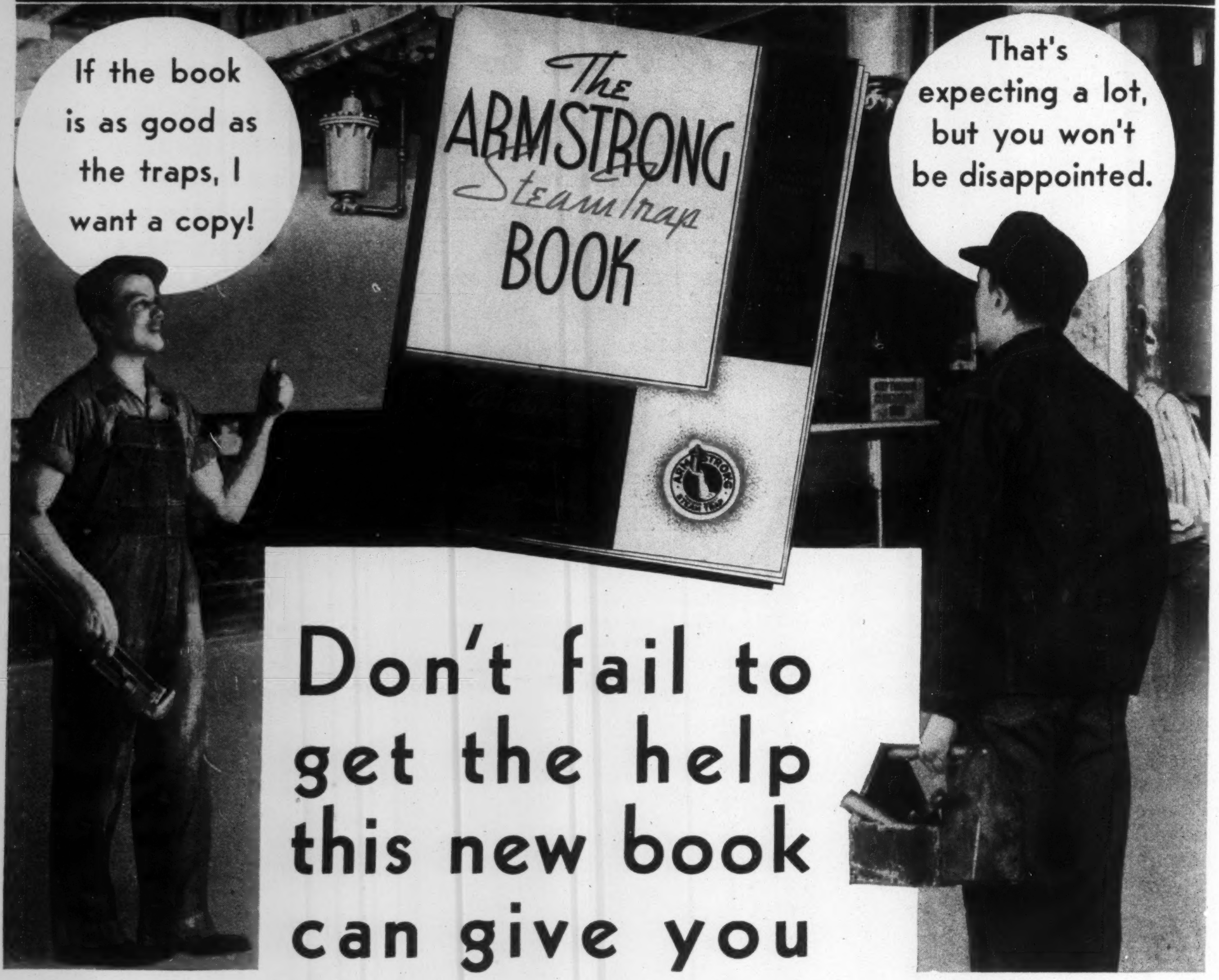
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Buffalo, N. Y., Herr Steam Specialty Co.
Charleston, W. Va., Baldwin Supply Co.
Chicago, Ill., Barrett-Christie Co.
Dallas, Texas, Geo. B. Allan & Co.
Denver, Hendrie-Bolthoff Mfg. & Supply Co.
Des Moines, Ia., E. B. Carr, 307 Securities Bldg.
Detroit, Mich., A. F. Squier, 2910 National Ave.
Duluth, Minn., John E. Smith, 1720 W. Superior Street
Erie, Pa., Coblentz Equipment Co.
Evansville, Ind., Evansville Supply Co.
Fond du Lac, Wis., A. N. Goff
Honolulu, T. H., The von Hamm-Young Company, Ltd.
Indianapolis, Ind., Ind. Belting & Supply Co.
Kansas City, Mo., Hughes Machinery Co.
Knoxville, Tenn., Leinart Engineering Co.
Los Angeles, Guy L. Warden, 114 W. 17th St.
Louisville, Ky., Graft-Pelle Co.
Memphis, Tenn., The Power Equipment Co.
Milwaukee, Wis., Hamacher & Williams
Minneapolis, Minn., Albert C. Price Co.
Montreal, Quebec, Preston, Phipps, Inc.
New Orleans, La., Louisiana Steam Equipment Co.
New York, N. Y., Advance Engineering Co.
Philadelphia, Pa., Brogan & Co.
Phoenix, Ariz., John W. Ladlow
Pittsburgh, Pa., R. S. Eastman Co.
Portland, Oregon, Arthur Forsyth Co., 927 S. W. Oak St.
Richmond, Va., Allan T. Shepherd Company, 411-12 Tenth St. Bldg.
St. Louis, Mo., O'Brien Equipment Co.
Salt Lake City, Utah, Lee, Pace & Turpin
San Francisco, Calif., Refrigerating & Power Specialties Co.
Seattle, Arthur Forsyth Co., 500 First Ave., South
South Bend, Ind., Smith-Monroe Co.
Syracuse, N. Y., Hopton Company, 321 Denison Building
Tampa, Florida, G. W. Neale
Toronto 5, Ont., Arthur S. Leitch Co., Ltd.
Vancouver, B. C., General Equipment, Ltd.
Winnipeg, Man., Kipp-Kelly, Ltd.
Wooster, Ohio, Steam Economies Co.

HEATING ◆ PIPING AND AIR CONDITIONING

January, 1939

DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT *for* INDUSTRY AND LARGE BUILDINGS

HOW TO USE THIS DIRECTORY

If you want to know the names of one or more manufacturers making a certain product, look in Part 1, where that product will appear in its proper place in the listing. If you have the trade name of a product and want to know who manufactures it, look in Part 2, where trade names are alphabetically listed. For the complete name and address of any manufacturer look in Part 3.

● The manufacturers whose names are spotted throughout the listings advertise in this issue. See Index to Advertisers (on next page) for the page on which you will find the advertising of any of these manufacturers.

Heating, Piping and Air Conditioning, Chicago, Ill.

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ANALYZERS, GAS
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Engelhard, Inc., Chas., Newark, N. J.
Friez & Sons, Julien P., Baltimore, Md.
Hays Corp.. Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Permutit Co., New York, N. Y.
Willson Products, Inc., Reading, Pa.

ANEMOMETERS
American Instrument Co., Silver Spring, Md.
Bristol Co., Waterbury, Conn.
Friez & Sons, Julien P., Baltimore, Md.
Hill, E. Vernon, Chicago, Ill.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Taylor Instrument Companies, Rochester, N. Y.
Willson Products, Inc., Reading, Pa. (Thermometer type)

ANGLE VALVES
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ANGLES, BARS, BEAMS, CHANNELS AND TEES (STRUCTURAL SHAPES)
●American Brass Co., Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Byers Co., A. M., Pittsburgh, Pa.
Carnegie-Illinois Steel Co., Pittsburgh, Pa.
Chase Brass & Copper Co., Waterbury, Conn. (Brass, copper, bronze)
Colonial Alloys Co., Specialties Div., Philadelphia, Pa.
Crown Iron Works, Minneapolis, Minn.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
●Republic Steel Corp., Cleveland, O.
●Revere Copper and Brass, Inc., New York, N. Y.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Truscon Steel Co., Youngstown, O.
United States Steel Corp., Pittsburgh, Pa.
Weirton Steel Co.. Weirton, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

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ASBESTOS PACKING
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BALL BEARINGS
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BASES AND PADS, VIBRATION ISOLATING
American Pulley Co., Philadelphia, Pa.
●Armstrong Cork Co., Lancaster, Pa.
●Buffalo Forge Co., Buffalo, N. Y.
Butterworth, B. T., Jr., New Canaan, Conn.
●Cork Import Corp.. New York, N. Y.
Cork Insulation Co., Inc., New York, N. Y.
Fabling Co., W. D., Los Angeles, Cal.
Felt Products Mfg. Co., Chicago, Ill.
Felters Co., Inc., Boston, Mass.
Firestone Tire & Rubber Co., Akron. O.
General Electric Co., Schenectady, N. Y.
Goodrich Co., B. F., Akron, O.
Keldur Corp., New York, N. Y.
Korfund Co., Long Island City, N. Y.
Lord Mfg. Co., Erie, Pa.
Manley Products Corp.. York. Pa.
●Mundet Cork Corp., Brooklyn, N. Y.
National Lead Co., New York, N. Y.
United Cork Companies, Lyndhurst, N. J.
United States Gypsum Co., Chicago, Ill.
Vibration Eliminator Co., Long Island City, N. Y.
Western Felt Works, Chicago, Ill. (Felt)

BEARINGS, BALL
Ahlberg Bearing Co., Chicago, Ill.
Bearings Co. of America, Lancaster, Pa.
Dodge Mfg. Co., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
New Departure Div., General Motors Corp., Bristol, Conn.
Norma-Hoffman Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Philadelphia, Pa.
Schatz Mfg. Co., Fairview, Poughkeepsie, N. Y.
Shafer Bearing Corp., Chicago, Ill.

BEARINGS, ROLLER
Dodge Mfg. Co., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Roller Bearing Co., Harrison, N. J.
Link-Belt Co., Chicago, Ill.
Medart Co., St. Louis, Mo.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Trenton, N. J.
SKF Industries, Inc., Philadelphia, Pa.
Shafer Bearing Corp., Chicago, Ill.
Timken Roller Bearing Co., Canton, O.

BEARINGS, SLEEVE
Dodge Mfg. Co., Mishawaka, Ind.
Federal-Mogul Corp., Detroit, Mich.

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Hastings Air Conditioning Co., Hastings, Neb.
Johnson Bronze Co., New Castle, Pa.
●Randall Graphite Products Corp., Chicago, Ill.

BELLOWS, THERMOSTATIC

Bishop & Babcock Mfg. Co., Cleveland, O.
Bridgeport Thermostat Co., Bridgeport, Conn.
Cashin Co., W. D., Boston, Mass.
●Clifford Mfg. Co., Boston, Mass.
Cook Electric Co., Chicago, Ill.
●Fulton Sylphon Co., Knoxville, Tenn.

BELTING, FLAT, LEATHER

Alexander Bros., Inc., Philadelphia, Pa.
Chicago Belting Co., Chicago, Ill.
Graton & Knight, Worcester, Mass.
Houghton & Co., E. F., Philadelphia, Pa.
Rhoads & Sons, J. E., Wilmington, Del.
Williams & Son, I. B., Dover, N. H.

BELTING, FLAT, RUBBER

Boston Woven Hose & Rubber Co., Cambridge, Mass.
Continental Rubber Wks., Erie, Pa.
Dick Co., Inc., R. & J., Passaic, N. J.
Firestone Tire & Rubber Co., Akron, O.
Garlock Packing Co., Palmyra, N. Y.
Gilmer Co., L. H., Philadelphia, Pa.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Hamilton Rubber Mfg. Co., Trenton, N. J.
Jeffrey Mfg. Co., Columbus, O.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
Thermoid Rubber Co., Trenton, N. J.
United States Rubber Co., New York, N. Y.

BELTS, V

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Browning Mfg. Co., Inc., Ohio Valley Pulley Works, Div., Maysville, Ky.
Chicago Belting Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J.
Gates Rubber Co., Denver, Colo.
Gilmer Co., L. H., Philadelphia, Pa.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Graton & Knight Mfg. Co., Worcester, Mass.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Medart Co., St. Louis, Mo.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
Rockwood Mfg. Co., Indianapolis, Ind.
Thermoid Rubber Co., Trenton, N. J.
United States Rubber Co., New York, N. Y.
●Worthington Pump & Machinery Corp., Harrison, N. J.

BENDERS, PIPE

American Pipe Bending Machine Co., Inc., Boston, Mass.
American Pipe Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Bernz Co., Inc., Otto, Rochester, N. Y.
●Buffalo Forge Co., Buffalo, N. Y.
Crown Die & Tool Co., Chicago, Ill.
Grabler Mfg. Co., Cleveland, O.
Hollands Mfg. Co., Erie, Pa.
Holsclaw Bros., Inc., Evansville, Ind.
Jenkins Mfg. Co., New York, N. Y.
Martin & Sons, H. P., Owensboro, Ky.
National Pipe Bending Co., New Haven, Conn.
Toledo Pipe Threading Machine Co., Toledo, O.
U. S. Pipe Bending Co., San Francisco, Cal.
Vanderman Mfg. Co., Willimantic, Conn.
Wallace Supplies Mfg. Co., Chicago, Ill.
●Watson-Stillman Co., Roselle, N. J.

BENDERS, TUBING

Bernz Co., Inc., Otto, Rochester, N. Y.
●Buffalo Forge Co., Buffalo, N. Y.
Grabler Mfg. Co., Cleveland, O.
Hays Mfg. Co., Erie, Pa. (Copper Tube)
Holsclaw Bros., Inc., Evansville, Ind.
Imperial Brass Mfg. Co., Chicago, Ill.
Martin & Sons, H. P., Owensboro, Ky.
Mueller Brass Co., Port Huron, Mich.
National Pipe Bending Co., New Haven, Conn.
Parker Appliance Co., Cleveland, O.
Sac Tool Mfg. Co., St. Louis, Mo.
Snap-On Tools Corp., Kenosha, Wis.
Toledo Pipe Threading Machine Co., Toledo, O.
U. S. Pipe Bending Co., San Francisco, Cal.
Wallace Supplies Mfg. Co., Chicago, Ill.

BENDS, EXPANSION, STEAM PIPE

Blaw-Knox Co., Blawnox, Pa.
Chicago Nipple Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
●Grinnell Co., Inc., Providence, R. I.
Harris & Co., Arthur, Chicago, Ill. (Stainless & non-ferrous)
Harrisburg Steel Corp., Harrisburg, Pa.
Kellogg Co., M. W., The, New York, N. Y. (Corrugated steel)
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden & Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Pipe Bending Co., New Haven, Conn.
National Valve & Mfg. Co., Pittsburgh, Pa.
Ohio Pipe Bending & Machine Co., Cleveland, O.
Parks-Cramer Co., Fitchburg, Mass.
Pittsburgh Pipe Coil & Bending Co., Etna, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
●Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Shaw Co., Benjamin F., Wilmington, Del.
Shaw-Kendall Engineering Co., Toledo, O.
U. S. Pipe Bending Co., San Francisco, Cal.
Vogt Machine Co., Henry, Louisville, Ky.

BI-METALS, THERMOSTATIC

Chace Valve Co., W. M., Detroit, Mich.
Dole Valve Co., Chicago, Ill.
General Plate Co., Attleboro, Mass.
Wilson Co., H. A., Newark, N. J.

BLADES, FAN

Airmaster Corp., Chicago, Ill.
Allen Corp., Detroit, Mich.
Berns Specialty Co., Chicago, Ill.
Browning Mfg. Co., Inc., Ohio Valley Pulley Works Div., Maysville, Ky.
●Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., New York, N. Y.
Dallas Engineering Co., Inc., Dallas, Tex.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
International Engrg., Inc., Dayton, O.
Janette Mfg. Co., Chicago, Ill.
Lohman, Inc., Wm. J., New York, N. Y.
Meier Electric & Machine Co., Indianapolis, Ind.
Myers Electric Co., Pittsburgh, Pa.
Norwin Co., Freeport, Ill.
Peerless Electric Co., Warren, O.
Reed Unit-Fans, Inc., New Orleans, La.
Schwitzer-Cummins Co., Indianapolis, Ind.
South Bend Air Products Corp., South Bend, Ind.
Torrington Mfg. Co., Torrington, Conn.

BLAST HEATERS

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BLAST HEATING COILS

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BLINDS, VENETIAN

Athey Co., Chicago, Ill.
Bostwick-Goodell Co., Norwalk, O. (Shutter awnings)
Chicago Venetian Blind Co., Chicago, Ill.
Columbia Mills, Inc., Saginaw, Mich.
Higgin Products, Inc., Newport, Ky.
Hough Shade Corp., Janesville, Wis.
Kane Mfg. Corp., Kane, Pa.
Miller & Connell Co., Chicago, Ill.
Mitchell Moulding Co., Forest Park, Ill.
Patterson Shade Co., Indianapolis, Ind.
Schatz Venetian Blinds, Los Angeles, Cal.
Snead, Herbert S., New York, N. Y.
Standard Products Co., Detroit, Mich.
Swedish Venetian Blind Co., New York, N. Y.
Warren Shade Co., Inc., Minneapolis, Minn.
Western Venetian Blind Co., New York, N. Y.
Yardley Screen & Weather Strip Co., Columbus, O.

BLOCKS, PILLOW

Ahlberg Bearing Co., Chicago, Ill.
Air Controls, Inc., Cleveland, O.
Caldwell Co., W. E. Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Clizbe Bros. Mfg. Co., Plymouth, Ind.
Dodge Mfg. Co., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Hastings Air Conditioning Co., Hastings, Neb.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Medart Co., St. Louis, Mo.
Peerless Electric Co., Warren, O.

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●Randall Graphite Products Corp., Chicago, Ill.
SKF Industries, Inc., Philadelphia. Pa.
Schwitzer-Cummins Co., Indianapolis, Ind.
Shafer Bearing Corp., Chicago, Ill.
Sprout, Waldron & Co., Muncy, Pa.
Viking Air Conditioning Corp., Cleveland, O.

BLOWERS

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BLOWERS, PRESSURE

Air Controls, Inc., Cleveland, O.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Blower Corp., Detroit, Mich.
Arex Co., Chicago, Ill.
●Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Beach-Russ Co., New York, N. Y.
Bishop & Babcock Mfg. Co., Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Burdett Mfg. Co., Chicago, Ill.
Carling Turbine Blower Co., Worcester, Mass.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Eclipse Fuel Engineering Co., Rockford, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Eisler Engineering Corp., Newark, N. J.
Garden City Fan Co., Chicago, Ill.
General Blower Co., Inc., Philadelphia, Pa.
Ingersoll-Rand Co., New York, N. Y.
International Engineering, Inc., Dayton, O.
Kraissl Co., Inc., The. Hackensack, N. J.
Leiman Bros., Inc., Newark, N. J.
Muncie Gear Wks., Muncie, Ind.
North American Mfg. Co., Cleveland, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Spencer Turbine Co., Hartford, Conn.
Sturtevant Co., B. F., Boston, Mass.
Trimount Rotary Power Co., East Dedham, Mass.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.

BLOWERS, SOOT

Bayer Co., St. Louis, Mo.
Bishop & Babcock Mfg. Co., Cleveland, O.
Diamond Power Specialty Corp., Detroit, Mich.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Marion Machine Foundry & Supply Co., Marion, Ind.
Perfection Grate & Stoker Co. Springfield, Mass.

BLOWER WHEELS

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BLOW-OFF VALVES

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BOILER CLEANING COMPOUNDS

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BOILER FEED PUMPS

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BOILER FEEDERS

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BOILER SEALING COMPOUNDS

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BOILER AND TANK INSULATION

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BOILER TUBES

See Tubes, Boiler

BOILERS, HEATING, CAST IRON, SECTIONAL

American Gas Products, Div. of American Radiator Co., New York, N. Y.
American Radiator Co., New York, N. Y.
Bryan Steam Corp., Peru, Ind.
●Burnham Boiler Corp., Irvington, N. Y.
Columbia Radiator Co., McKeesport, Pa.
●Crane Co., Chicago. Ill.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Hart & Crouse Corp., Utica, N. Y.
Herbert Boiler Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Mueller Furnace Co., L. J., Milwaukee. Wis.
National Radiator Corp., Johnstown, Pa.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Inc., Frank, Terre Haute, Ind.
Richardson & Boynton Co., New York, N. Y.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Smith Co., H. B., Westfield, Mass.
Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.
Thatcher Furnace Co., Newark, N. J.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago. Ill.
XXth Century H. & V. Co., Akron, O.

BOILERS, HEATING, STEEL, FIRE TUBE

Ames Iron Wks., Div. of Pierce Butler Radiator Corp., Oswego, N. Y.
Bass Foundry & Machine Co., Ft. Wayne, Ind.
Bigelow Co., New Haven, Conn.
Bros Boiler & Mfg. Co., Wm., Minneapolis. Minn.
Brownell Co., Dayton, O.
●Burnham Boiler Corp., Irvington, N. Y.
Cleaver-Brooks Co., Milwaukee, Wis.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., New York, N. Y.
Dillon Steam Boiler Wks., Inc., D. M., Fitchburg, Mass.
Eclipse Fuel Engineering Co., Rockford, Ill.
Erie City Iron Wks., Erie, Pa.
Farquhar Co., Ltd., A. B., York, Pa.
Farrar & Trefts, Buffalo, N. Y.
Fitzgibbons Boiler Co., Inc.. New York, N. Y.
Frost Mfg. Co., Galesburg, Ill.
Heil Co., Milwaukee, Wis.
Herbert Boiler Co., Chicago, Ill.
Hodge Boiler Wks., East Boston, Mass.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Inc.. Framingham, Mass.
Johnston Bros., Inc., Ferrysburg, Mich.
Keeler Co., Williamsport, Pa.
●Kewanee Boiler Corp., Kewanee, Ill.
Kisco Co., Inc., St. Louis, Mo.
Leffel & Co., Springfield, O.
Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
Manitowoc Boiler Wks., Manitowoc, Wis.
●Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
Murray Iron Wks. Co., Burlington, Ia.
National Radiator Corp., Johnstown, Pa.
Orr & Sembower, Inc., Reading, Pa.
PS Inc., Los Angeles, Cal. (Flash type)
Pacific Steel Boiler Div., United States Radiator Corp., Detroit, Mich.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Smith Twin Tubular Boiler Co., Inc., Philadelphia, Pa.
Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.
Titusville Iron Wks. Co., Titusville, Pa.
Union Iron Wks., Erie, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Vortex Mfg. Co., Portland, Ore.
Waterfilm Boilers, Inc., Jersey City, N. J.
Wickes Boiler Co., Saginaw, Mich.
Wood Industries, Inc., Gar, Detroit, Mich.

BOILERS, HEATING, STEEL, WATER TUBE

Babcock & Wilcox Co., New York, N. Y.
Bass Foundry & Machine Co., Ft. Wayne, Ind.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Bryan Steam Corp., Peru, Ind.
Campbell Heating Co., E. K., Kansas City, Mo.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., New York, N. Y.
Edge Moor Iron Wks., New York, N. Y.
Erie City Iron Wks., Erie, Pa.
Farquhar Co., Ltd., A. B., York, Pa.
Foster Wheeler Corp., New York, N. Y.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Inc.. Framingham, Mass.
Joliet Heating Corp., Joliet, Ill.
Keeler Co., E.. Williamsport, Pa.
Koven & Bro., L. O., Jersey City, N. J.
●Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Murray Iron Wks. Co., Burlington, Ia.
Orr & Sembower, Inc., Reading, Pa.
Riley Stoker Corp., Worcester, Mass.
Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.
Titusville Iron Wks. Co., Titusville, Pa.
United States Radiator Corp., Detroit, Mich.
Vogt Machine Co., Henry, Louisville, Ky.
Wickes Boiler Co., Saginaw, Mich.

BOLTS AND STUDS, FLANGE

Bethlehem Steel Co., Bethlehem, Pa.
●Crane Co., Chicago, Ill.
Erie Bolt & Nut Co., Erie, Pa.
Lamson & Sessions Co., Cleveland, O.
Multi-Seal Mfg. Co., Chicago, Ill.
●Republic Steel Corp., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOLTS, EXPANSION

Chicago Expansion Bolt Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Diamond Expansion Bolt Co., Garwood, N. J.
Multi-Seal Mfg. Co., Chicago, Ill.
National Lead Co., New York, N. Y.
Paine Co., Chicago, Ill.
Rawlplug Co., Inc., New York, N. Y.
●Republic Steel Corp., Cleveland, O.
Star Expansion Bolt Co., New York, N. Y.
U. S. Expansion Bolt Co., York, Pa.

BOLTS, TOGGLE AND ANCHOR

Chicago Expansion Bolt Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Diamond Expansion Bolt Co., Garwood, N. J.

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Grabler Mfg. Co., Cleveland, O.
Lamson & Sessions Co., Cleveland, O.
Multi-Seal Mfg. Co., Chicago, Ill.
Paine Co., Chicago, Ill.
Rawlplug Co., Inc., New York, N. Y.
●Republic Steel Corp., Cleveland, O.
Star Expansion Bolt Co., New York, N. Y.
U. S. Expansion Bolt Co., York, Pa.

BRAKES, SHEET METAL

Bertsch & Co., Cambridge City, Ind.
Cincinnati Shaper Co., Cincinnati, O.
Dreis & Krump Mfg. Co., Chicago, Ill.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Heartley Machine & Tool Co., Toledo, O.
New Albany Machine Mfg. Co., New Albany, Ind.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Ohl & Son, George A., Newark, N. J.
Peck, Stow & Wilcox Co., Southington, Conn.
Rafter Machine Co., Belleville, N. J.
Steelweld Machinery Co., Cleveland, O.
Verson Allsteel Press Co., Chicago, Ill.
●Whitney Metal Tool Co., Rockford, Ill.

BRASS PIPE

See Pipe, Brass

BRASS UNIONS

See Unions, Brass

BRASS VALVES

See Valves, Gate and Valves, Globe

BRAZING TORCHES

See Torches, Brazing

BRONZE VALVES

See Valves, Gate and Valves, Globe

BUILDING INSULATION

See Insulation, Building

BURNERS, COAL, AUTOMATIC

See Stokers

BURNERS, GAS, COMMERCIAL AND INDUSTRIAL

American Gas Products, Div. of American Radiator Co., New York, N. Y.
Babcock & Wilcox Co., New York, N. Y.
Barber Gas Burner Co., Cleveland, O.
Bryan Steam Corp., Peru, Ind.
Bryant Heater Co., The, Cleveland, O.
Burdett Mfg. Co., Chicago, Ill.
Campbell Heating Co., E. K., Kansas City, Mo.
Continental Stove Corp., Ironton, O.
Coppus Engineering Corp., Worcester, Mass.
Eclipse Fuel Engrg. Co., Rockford, Ill.
Engineer Co., New York, N. Y.
General Electric Co., Air Conditioning Dept.. Bloomfield, N. J.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Hugo Mfg. Co., West Duluth, Minn.
Martin, J. O. & C. U., San Francisco, Cal.
●Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Mettler Co., Lee B.. Los Angeles, Cal.
National Machine Wks., Chicago, Ill.
Norge Heating & Conditioning Div., Borg-Warner Corp., Detroit, Mich.
North American Mfg. Co., Cleveland, O.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Peabody Engrg. Corp., New York. N. Y.
R-S Products Corp., Philadelphia, Pa.
Reznor Mfg. Co., Mercer, Pa.
Roberts-Gordon Appliance Corp., Buffalo, N. Y.
Rotary Mfg. Co., Los Angeles, Cal.
Schutte & Koerting Co., Philadelphia, Pa.
Staples & Pfeiffer, Ltd.. San Francisco, Cal.
Surface Combustion Corp., Toledo, O.
Williams, Inc., F. C., Dearborn, Mich.

BURNERS, OIL, COMMERCIAL AND INDUSTRIAL

Ace Engineering Co., Chicago, Ill.
●Airtemp, Div. of Chrysler Corp., Dayton, O.
American Air Conditioning Corp., Sebastopol, Cal.
Babcock & Wilcox Co., New York, N. Y.
Bennett Co., Omaha, Nebr.
Bryan Steam Corp., Peru, Ind.
Caloroil Burner Corp., Hartford, Conn.
Century Engrg. Corp., Cedar Rapids, Ia.
Chalmers Oil Burner Co., Minneapolis, Minn.
Chisholm Co., Allen E., Portland, Ore.
Cleaver-Brooks Co., Milwaukee, Wis.
Combustion Engineering Co., Inc., New York, N. Y.
Connery Construction Co., Philadelphia, Pa.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
d'Este Co., Julian, Charlestown, Mass.
Electrol, Inc., Clifton, N. J.
Engineering Co., New York, N. Y.
Enterprise Oil Burner Co., San Francisco, Cal.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hardinge Mfg. & Oil Burner Co., Chicago, Ill.
Heil Co., Milwaukee. Wis.
Holtum Mfg. Co., Freeport, Ill.
Johnson Co., S. T., Oakland, Cal.
Johnson Mfg. Co., Waterloo, Ia.
Kisco Co., Inc., St. Louis, Mo.
Kleen-Heet, Inc.. Chicago, Ill.
Lammert & Mann Co., Chicago, Ill.
Leiman Bros., Inc., Newark, N. J.
Littleford Bros., Cincinnati, O.
Mettler Co., Lee B., Los Angeles, Cal.
Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
National Airoil Burner Co., Inc., Philadelphia, Pa.
Norge Heating & Conditioning Div., Borg-Warner Corp., Detroit, Mich.
North American Mfg. Co., Cleveland, O.
Nu-Way Corp., Rock Island, Ill.
Peabody Engrg. Corp., New York, N. Y.
Petroleum Heat & Power Co., Stamford, Conn.
R-S Products Corp., Philadelphia, Pa.
Ray Oil Burner Co., San Francisco. Cal.
Reif-Rexoil, Inc., Buffalo, N. Y.
Riley Stoker Corp., Worcester, Mass.
Rotary Mfg. Co., Los Angeles, Cal.
Schutte & Koerting Co., Philadelphia, Pa.
Silent Glow Oil Burner Corp., Hartford, Conn.
Simplex Oil Heating Corp.. New York, N. Y.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Todd Combustion Equipment, Inc., Brooklyn, N. Y.
Vortex Mfg. Co., Portland, Ore.
Wayne Oil Burner Corp., Fort Wayne, Ind.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
Wood Industries. Inc., Gar, Detroit, Mich.
York Oil Burner Co., Inc., York, Pa.

CARBON DIOXIDE INDICATORS

See Indicators, Carbon Dioxide

CAST IRON PIPE

See Pipe, Cast Iron

CEMENT AND COMPOUNDS, PIPE JOINT

Acorn Refining Co., Cleveland, O.
Akron Metallic Gasket Co., Akron, O.
Atlas Chemical Co., Marietta, O.
●Bell & Gossett Co., Chicago, Ill.
Blue Seal Chemical Co.. Roselle Park. N. J.
Burnley Battery & Mfg. Co., North East, Pa.
Calbar Paint & Varnish Co., Philadelphia, Pa.
Colebrook & Sons, Inc., W. H., Syracuse, N. Y.
Cooper Sanitary Co., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Croll & Son, Jesse G., Philadelphia, Pa.
Desolvo Mfg. Co., Pittsburgh, Pa.
Detroit Graphite Co., Detroit, Mich.
Dixon Crucible Co., Joseph, Jersey City, N. J.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
●Grinnell Co., Inc., Providence, R. I.
Hercules Chemical Co., Inc.. New York, N. Y.
Hilo Varnish Corp., Brooklyn, N. Y.
Key Co., East St. Louis, Ill.
National Boiler Improvement Co., Washington, D. C.
Radiator Specialty Co., Charlotte, N. C.
●Ric-wiL Co., Cleveland, O.
Rockwood Sprinkler Co., Worcester. Mass.
Sauereisen Cements Co., Sharpsburg, Pa.
Schundler & Co., F. E., Long Island City, N. Y.
Smooth-On Mfg. Co., Jersey City, N. J.
Star Products Co., New York, N. Y.
U. S. Stonewear Co., New York, N. Y.
X-Pando Corp., Long Island City, N. Y.

CEMENT, INSULATING

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Armstrong Co., Detroit, Mich.
Carey Co., Philip, Lockland, Cincinnati, O.
Eagle-Picher Lead Co., Cincinnati, O.
Ehret Magnesia Mfg. Co.. Valley Forge, Pa.
General Insulating & Mfg. Co., St. Louis, Mo.
Industrial Research, Lansdowne, Pa.
Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Mineral Felt Co., Toledo. O.
Mineral Insulation Co., Chicago Ridge, Ill.
Mortell Co., J. W., Chicago, Ill. (Adhesive)
Norristown Magnesia & Asbestos Co., Norristown, Pa.
Pecora Paint Co., Philadelphia, Pa. (Asbestos furnace cement)
Refractory & Insulation Corp., New York, N. Y.
Rex Clay Products Co.. Detroit, Mich.
Ruberoid Co., New York, N. Y.
Sall Mountain Co., Chicago, Ill.
Sauereisen Cements Co., Sharpsburg, Pa.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Self-Vulcanizing Rubber Co., Inc., Chicago, Ill.
Smith & Kanzler, Inc., Elizabeth, N. J.
Standard Lime & Stone Co., Baltimore, Md.
Therminsul Corp., Kalamazoo, Mich.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Wilson, Inc., Grant, Chicago, Ill.

● Advertisement in this issue. See Index to Advertisers, page 168.

CENTRIFUGAL PUMPS

See Pumps, Centrifugal

CHAIN DRIVES

See Drives, Chain

CHANGERS, SPEED, HYDRAULIC COUPLING

American Blower Corp., Detroit, Mich.
●U. S. Air Conditioning Corp., Minneapolis, Minn.

CHANGERS, SPEED, MECHANICAL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dodge Mfg. Co., Mishawaka, Ind.
Link-Belt Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CHECK VALVES

See Valves, Check

CHILLERS, WATER, FOR AIR CONDITIONING AND REFRIGERATION

Acme Industries, Inc., Jackson, Mich.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Drayer & Hanson, Inc., Los Angeles, Cal.
Filtrine Mfg. Co., Brooklyn, N. Y.
●Frick Co., Waynesboro, Pa.
Griscom-Russell Co., New York, N. Y.
Howe Ice Machine Co., Chicago, Ill.
Mojonnier Bros. Co., Chicago, Ill.
Norge Div., Borg-Warner Corp., Detroit, Mich.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
●Refrigeration Economics Co., Inc., Canton, O.
Richmond Engineering Co., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Sims Co., Erie, Pa.
●Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
Whitehead Metal Products Co. of New York, Inc., New York, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
●York Ice Machinery Corp., York, Pa.

CIRCULATORS FOR HOT WATER HEATING SYSTEMS

Automatic Stoker Corp., Milwaukee, Wis.
●Bell & Gossett Co., Chicago, Ill.
Berns Specialty Co., Chicago, Ill.
Columbus Steam Pump Works Co., Columbus, O.
Economy Pumps, Inc., Chicago, Ill.
Frederick Iron & Steel Co., Frederick, Md.
General Blower Co., Inc., Philadelphia, Pa.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Hoosick Engineering Co., Inc., Hoosick Falls, N. Y.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penberthy Injector Co., Detroit, Mich.
Roots-Connersville Blower Corp., Connersville, Ind.
Sterling Engineering Co., Milwaukee, Wis.
Stevens-Root Co., Chicago, Ill.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
Triplex Mfg. Co., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.
Weil Pump Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

CLAMPS, BEAM, PIPE HANGING

Beaton & Cadwell Mfg. Co., New Britain, Conn.
Chicago Nipple Mfg. Co., Chicago, Ill.
Carpenter & Paterson, Inc., East Boston, Mass.
●Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Farley Sleeve & Hanger Co., Cleveland, O.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Jarecki Mfg. Co., Erie, Pa.
National Valve & Mfg. Co., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rockwood Sprinkler Co., Worcester, Mass.
Walworth Co., New York, N. Y.

CLAMPS, PIPE REPAIR

Chelsea Metal Stamping Co., New York, N. Y.
Dresser Mfg. Co., S. R., Bradford, Pa.
Inner-Tite Clamp Corp., Elizabeth, N. J.
Jarecki Mfg. Co., Erie, Pa.
Skinner Co., M. B., South Bend, Ind.

CLEANERS, AIR, ELECTRICAL

Pangborn Corp., Hagerstown, Md.
Spencer Turbine Co., Hartford, Conn.
Westinghouse Electric & Mfg. Co., Cleveland, O.

CLEANERS, TUBE

Huyette Co., Inc., Paul B., Philadelphia, Pa.
Perfection Grate & Stoker Co., Springfield, Mass.
Pierce Co., Wm. B., Buffalo, N. Y.
Pilley Packing & Flue Brush Co., St. Louis, Mo.
Spencer Turbine Co., Hartford, Conn.

COILS

See Surface, Cooling; Surface, Heating

COILS, PIPE

Acme Industries, Inc., Jackson, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Chicago Nipple Mfg. Co., Chicago, Ill.
General Refrigeration Corp., Beloit, Wis.
LUL Products, Inc., Baltimore, Md.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Pipe Bending Co., New Haven, Conn.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
Pittsburgh Pipe Coil & Bending Co., Etna, Pa.
Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
●Refrigeration Economics Co., Inc., Canton, O.
Richmond Engineering Co., Richmond, Va.
Sales & Co., Murray W., Detroit, Mich.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
U. S. Pipe Bending Co., San Francisco, Cal.
●York Ice Machinery Corp., York, Pa.

COLLECTORS, DUST

●Airtherm Mfg. Co., St. Louis, Mo.
Allen Billmyre Corp., South Norwalk, Conn.
American Air Filter Co., Louisville, Ky.
American Blower Corp., Detroit, Mich.
American Foundry Equipment Co., Mishawaka, Ind.
Belanger Fan & Oven Co., Detroit, Mich.
Blower Application Co., Milwaukee, Wis.
Bubar, Hudson H., New York, N. Y.
●Buffalo Forge Co., Buffalo, N. Y.
Chicago Metal Mfg. Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Diamond Power Specialty Corp., Detroit, Mich.
Dracco Corp., Cleveland, O.
Falstrom Co., Passaic, N. J.
Garden City Fan Co., Chicago, Ill.
Goethel Co., Alfred C., Milwaukee, Wis.
Goethel Sheet Metal Wks., Alfred, Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Jacobs Co., B. & J., Cincinnati, O.
Kirk & Blum Mfg. Co., Cincinnati, O.
Knickerbocker Co., Jackson, Mich.
Leiman Bros., Inc., Newark, N. J.
New York Blower Co., Chicago, Ill.
Northern Blower Co., Cleveland, O.
Pangborn Corp., Hagerstown, Md.
Research Corp., New York, N. Y.
●St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Schneible Co., Claude B., Chicago, Ill.
Sly Mfg. Co., W. W., Cleveland, O.
Spencer Turbine Co., Hartford, Conn.
Sprout Waldron & Co., Muncy, Pa.
Steamaire Co., Cincinnati, O.
Sturtevant Mill Co., Boston, Mass.
Western Precipitation Corp., Los Angeles, Cal.

COMBUSTION CONTROL

See Regulators, Draft

COMBUSTION CONTROL SYSTEMS

See Systems, Combustion Control

COMBUSTION RECORDERS

See Recorders, Combustion

COMFORT AIR CONDITIONERS

See Units, Air Conditioning, Comfort

COMPOUNDS, BOILER CLEANING

American Teksag Products, Inc., Mount Vernon, N. Y.
Aquatic Chemical Laboratories, Inc., New York, N. Y.
Blue Seal Chemical Co., Roselle Park, N. J.
Chicago Specialty Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Dissolene Corp., Hempstead, N. Y.
Ferro-Nil Corp., New York, N. Y.
Grief, Edward C., Bogota, N. J.
Haering & Co., Inc., D. W., Chicago, Ill.
Hercules Chemical Co., Inc., New York, N. Y.
Mouat Vapor Heating Co., The, Cleveland, O.
Radiator Specialty Co., Charlotte, N. C.
Star Products Co., New York, N. Y.
Vinco Co., Inc., New York, N. Y.
X Laboratories, New York, N. Y.

COMPOUNDS, BOILER AND RADIATOR SEALING

Atlas Chemical Co., Marietta, O.
Blue Seal Chemical Co., Roselle Park, N. J.
Chicago Specialty Mfg. Co., Chicago, Ill.
Cooper Sanitary Co., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Desolvo Mfg. Co., Pittsburgh, Pa.
Dole Valve Co., Chicago, Ill.
Hercules Chemical Co., Inc., New York, N. Y.
Radiator Specialty Co., Charlotte, N. C.

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- Star Products Co., New York, N. Y.
- Vinco Co., Inc., New York, N. Y.
- X Laboratories, New York, N. Y.

COMPOUNDS, CALKING

- All Metal Weatherstrip Co., Chicago, Ill.
- Armstrong Co., Detroit, Mich.
- Barland Weatherstrip Material Co., Cleveland, O.
- Calbar Paint & Varnish Co., Philadelphia. Pa.
- Carey Co., Philip, Cincinnati, O.
- Chamberlin Metal Weather Strip Co., Detroit, Mich.
- Pecora Paint Co., Philadelphia, Pa.
- Radiator Specialty Co., Charlotte, N. C.
- **X-Pando Corp., Long Island City, N. Y.**
- Yardley Screen & Weather Strip Corp.. Columbus, O.

COMPRESSOR BASES

See Bases and Pads, Vibration Isolating

COMPRESSORS, AIR

- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- American-Marsh Pumps, Inc., Battle Creek, Mich.
- Binks Mfg. Co., Chicago, Ill.
- ●Brunner Mfg. Co., Utica, N. Y.
- Bury Compressor Co., Erie, Pa.
- Chicago Pneumatic Tool Co., New York, N. Y.
- ●Curtis Refrigerating Machine Co., St. Louis, Mo.
- Dayton Air Compressor Co., Dayton, O.
- DeVilbiss Co., The, Toledo, O.
- Fedders Mfg. Co., Buffalo, N. Y.
- Fuller Co., Catasauqua, Pa.
- Gardner-Denver Co., Quincy, Ill.
- Gilbert & Barker Mfg. Co.. Springfield, Mass.
- Hobart Bros., Troy, O.
- Ingersoll-Rand, New York, N. Y.
- Janette Mfg. Co., Chicago, Ill.
- Kellogg Compressor & Mfg. Corp., Rochester, N. Y.
- Kraissl Co., Inc., The, Hackensack, N. J.
- Mills Novelty Co., Chicago, Ill.
- ●Nash Engineering Co., South Norwalk, Conn.
- Pennsylvania Pump & Compressor Co., Easton, Pa.
- Plummer Spray Equipment Co., Napoleon, O.
- Schramm, Inc., West Chester, Pa.
- Spencer Turbine Co., Hartford, Conn.
- Sturtevant Co., B. F., Hyde Park, Boston, Mass.
- Trimount Rotary Power Co., East Dedham, Mass.
- ●Worthington Pump & Machinery Corp., Harrison, N. J.
- Yeomans Bros. Co., Chicago, Ill.

COMPRESSORS, REFRIGERATING, CENTRIFUGAL

- ●Carrier Corp., Syracuse, N. Y. (Carrene)
- DeLaval Steam Turbine Co., Trenton, N. J. (Water vapor).
- Ingersoll-Rand. New York, N. Y. (Water vapor).
- ●Trane Co., LaCrosse, Wis.

COMPRESSORS, REFRIGERATING, RECIPROCATING

- Advanced Refrigerating Systems Co., Philadelphia, Pa.
- ●Airtemp, Div. of Chrysler Corp., Dayton, O. (Radial).
- ●Baker Ice Machine Co., Inc., Omaha, Nebr. ("Freon," Methyl chloride, Ammonia).
- ●Brunner Mfg. Co., Utica, N. Y. (Methyl chloride, "Freon," sulphur dioxide).
- ●Carrier Corp., Syracuse, N. Y. (Ammonia, "Freon," methyl chloride, carbon dioxide).
- Copeland Refrigeration Corp., Sidney, O.
- Corozone Air Conditioning Corp., Cleveland, O.
- ●Curtis Refrigerating Machine Co., St. Louis, Mo.
- De La Vergne Engine Co., Philadelphia, Pa. (Ammonia, "Freon").
- Delco Frigidaire Conditioning Div., General Motors Sales Corp., Dayton. O. (Freon").
- Fairbanks, Morse & Co., Chicago, Ill.
- ●Frick Co., Waynesboro, Pa. (Ammonia, carbon dioxide, methyl chloride, "Freon").
- General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
- General Refrigeration Corp., Beloit. Wis.
- Hardy Mfg. Co. Inc., Dayton O. (Sulphur dioxide, methyl chloride).
- Howe Ice Machine Co., Chicago, Ill. ("Freon," ammonia, methyl chloride).
- Kauffman Air Conditioning Corp., St. Louis, Mo.
- Kellogg Compressor & Mfg. Corp., Rochester, N. Y.
- ●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
- Merchant & Evans Co., Philadelphia, Pa. ("Freon," methyl chloride, sulphur dioxide).
- Mills Novelty Co., Chicago, Ill.
- Modern Equipment Corp., Defiance, O.
- Nash Refrigeration Co., Inc.. Newark, N. J.
- Norge Div., Borg-Warner Corp., Detroit, Mich.
- Phoenix Ice Machine Co., Cleveland, O.
- Reliance Refrigerating Machine Co., Chicago, Ill. ("Freon," methyl, ammonia).
- Servel Inc., Electric Refrigeration & Air Conditioning Div., Evansville, Ind. ("Freon," methyl chloride).
- Starr Piano Co., Richmond, Ind.
- Stewart Ice Machine Co., Los Angeles, Cal.
- Tecumseh Products Co., Tecumseh, Mich.
- ●Trane Co., La Crosse, Wis.
- Triumph Ice Machine Co., Cincinnati, O. (Ammonia).
- Uniflow Mfg. Co., Erie, Pa. (Sulphur dioxide, methyl chloride).
- ●Universal Cooler Corp., Detroit, Mich. (Methyl chloride, "Freon").
- ●Vilter Mfg. Co., Milwaukee, Wis. ("Freon," ammonia).
- Westinghouse Electric & Mfg. Co., East Springfield, Mass.
- Williams Oil-O-Matic Heating Corp., Bloomington, Ill. ("Freon,") methyl chloride).
- Wittenmeier Machinery Co., Chicago, Ill. (Carbon dioxide).
- ●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
- XL Refrigerating Co., Chicago, Ill. (Ammonia, methyl chloride).
- ●York Ice Machinery Corp., York, Pa. (Carbon dioxide, ammonia, "Freon").

COMPRESSORS, REFRIGERATING, STEAM JET

- American Blower Corp.. Detroit, Mich.
- ●Carrier Corp., Syracuse, N. Y.
- Croll-Reynolds Engrg. Co., Inc., New York, N. Y.
- Elliott Co., Jeannette, Pa.
- Foster Wheeler Corp., New York, N. Y.
- Graham Mfg. Co., Inc., Buffalo, N. Y.
- Ingersoll-Rand, New York, N. Y.
- Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
- Schutte & Koerting Co., Philadelphia, Pa.
- Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
- Wheeler Mfg. Co., C. H., Philadelphia, Pa.
- ●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.

CONDENSATION METERS

See Meters, Condensation

CONDENSATION PUMPS

See Pumps, Condensation

CONDENSERS, EVAPORATIVE

- Acme Industries, Inc., Jackson, Mich.
- ●Baker Ice Machine Co., Inc., Omaha, Nebr.
- ●Buffalo Forge Co., Buffalo, N. Y.
- ●Carrier Corp.. Syracuse, N. Y.
- ●Curtis Refrigerating Machine Co., St. Louis, Mo.
- Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
- Drayer & Hanson, Inc., Los Angeles, Cal.
- ●Frick Co., Waynesboro, Pa.
- General Refrigeration Corp., Beloit, Wis.
- Governair Corp.. Oklahoma City, Okla.
- ●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
- Larkin Coils, Inc., Atlanta, Ga.
- Long Mfg. Co., Div. Borg-Warner Corp., Detroit, Mich.
- Motor Equipment Co., Wichita, Kans.
- Peerless of America, Inc.. Chicago, Ill.
- ●Refrigeration Economics Co., Inc., Canton, O.
- Research Corp., New York, N. Y.
- Richmond Engrg. Co., Richmond, Va.
- Stewart Ice Machine Co., Los Angeles, Cal.
- ●Trane Co., La Crosse, Wis.
- ●Trenton Auto Radiator Wks., Trenton, N. J.
- ●Vilter Mfg. Co.. Milwaukee, Wis.
- Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
- ●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
- XL Refrigerating Co., Chicago. Ill.
- ●York Ice Machinery Corp., York, Pa.
- ●Young Radiator Co., Racine, Wis.

CONDENSERS, REFRIGERATING

- Acme Industries, Inc.. Jackson, Mich.
- Advanced Refrigerating Systems Co., Philadelphia, Pa.
- ●Baker Ice Machine Co., Inc., Omaha, Nebr.
- Bush Mfg. Co., Hartford, Conn.
- ●Carrier Corp., Syracuse, N. Y. (Carrene).
- De La Vergne Engine Co., Philadelphia, Pa.
- Delco-Frigidaire Conditioning Div.. General Motors Sales Corp., Dayton, O.
- Devine Mfg. Co., Inc., J. P., Mt Vernon, Ill.
- Drayer & Hanson, Inc., Los Angeles, Cal.
- Fedders Mfg. Co., Inc., Buffalo, N. Y.
- ●Frick Co.. Waynesboro, Pa.
- ●G. & O. Mfg. Co., New Haven, Conn.
- General Refrigeration Corp., Beloit, Wis.
- Harrison Radiator Div., Lockport, N. Y.
- Howe Ice Machine Co., Chicago, Ill.
- ●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
- Manufacturers Fin Coil Co., Chicago. Ill.
- Nash Refrigeration Co., Inc., Newark, N. J.
- Norge Div., Borg-Warner Corp., Detroit, Mich.
- Ohio Pipe Bending & Machine Co., Cleveland, O.
- ●Refrigeration Economics Co., Inc., Canton, O.
- Reliance Refrigerating Machine Co., Chicago, Ill.
- Richmond Engrg. Co., Richmond, Va.
- Roessing Mfg. Co., Pittsburgh, Pa.
- Rome-Turney Radiator Co., Rome, N. Y.
- Servel, Inc., Electric Refrigeration & Air Conditioning Div., Evansville, Ind.
- Stewart Ice Machine Co., Los Angeles, Cal.
- Struthers-Wells-Titusville Co.. Warren, Pa.
- Thermal Units Mfg. Co., Div. of Air Devices Corp., Meriden, Conn.
- ●Trenton Auto Radiator Wks., Trenton, N. J.

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Triumph Ice Machine Co., Cincinnati, O. (Ammonia).
●Unit Heater & Cooler Co., Wausau, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Vogt Machine Co., Henry, Louisville, Ky.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wittenmeier Machinery Co., Chicago, Ill.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
XL Refrigerating Co., Chicago, Ill.
Yates-American Machine Co., Beloit, Wis.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

CONDENSERS, STEAM

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Biggs Boiler Works Co., E. Akron, O.
Chicago Pneumatic Tool Co., New York, N. Y.
Columbian Steel Tank Co., Kansas City, Mo.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Devine Mfg. Co.. Inc., J. P., Mt. Vernon, Ill.
Elliott Co., Jeannette, Pa.
Foster Wheeler Corp., New York, N. Y.
Graham Mfg. Co., Buffalo, N. Y.
Murray Iron Wks. Co., Burlington, Ia.
National Pipe Bending Co., New Haven, Conn.
Richmond Engineering Co., Richmond, Va.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
●Unit Heater & Cooler Co., Wausau, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh. Pa.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

CONDENSING UNITS

See Compressors

CONDUIT, UNDERGROUND PIPING

●American District Steam Co., North Tonawanda, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
●Dockstader, S. E., Washington, D. C.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Johns-Manville, New York, N. Y.
●Porter & Co., Inc., H. W., Newark, N. J.
●Ric-wiL Co., Cleveland, O.
Underground Steam Construction Co., Boston, Mass.
Wyckoff & Son Co., A., Elmira, N. Y.

CONTROLLERS AND STARTERS, MOTOR

Allen-Bradley Co., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Elect. Co., Hartford, Conn.
Clark Controller Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
Durakool, Inc., Elkhart, Ind.
Electric Controller & Mfg. Co., Cleveland, O.
Electric Machinery Co., Minneapolis, Minn.
General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn.
Monitor Controller Co., Baltimore, Md.
Square D Co., Milwaukee, Wis.
Trumbull Electric Mfg. Co., Plainville, Conn.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONTROLS, HUMIDITY AND TEMPERATURE

See Humidistats, Recorder-Controllers, Thermostats

CONTROLS, REFRIGERATION

See Valves, Refrigeration

CONTROLS, SPRINKLER SYSTEM

American District Telegraph Co., New York, N. Y.
●Grinnell Co., Inc., Providence, R. I.
Paragon Electric Co., Chicago, Ill.
Rockwood Sprinkler Co., Worcester, Mass.
Square D Co., Detroit, Mich.

CONVECTORS

See Radiation, Convection Type

COOLERS, UNIT (FLOOR TYPE)

Acme Industries, Inc., Jackson, Mich.
Air Devices Corp., Meriden, Conn.
●Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Ballantyne Co., Omaha, Neb.
Betz Air Conditioning Corp., Kansas City, Mo.
●Buffalo Forge Co., Buffalo, N. Y.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co.. Chicago, Ill.
Coolmaster Corp., Chicago, Ill. (Evaporative cooling principle, no dehumidifying)
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
Fedders Mfg. Co., Inc., Buffalo, N. Y.
●Frick Co., Waynesboro, Pa.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
General Refrigeration Corp., Beloit, Wis.
Hastings Air Conditioning Co., Hastings, Neb.
Howe Ice Machine Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Mayflower-Lewis Corp., St. Paul, Minn.
●McQuay, Inc., Minneapolis, Minn.
Nelson Corp., Herman, Moline, Ill.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Peerless of America, Inc., Chicago, Ill.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
●Refrigeration Economics Co., Inc., Canton, O.
●Rempe Co., Chicago, Ill.
Richmond Engineering Co., Richmond, Va.
●St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
●Trane Co., LaCrosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
●Unit Heater & Cooler Co., Wausau, Wis.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

COOLERS, UNIT (SUSPENDED TYPE)

Acme Industries, Inc., Jackson, Mich.
American Blower Corp., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Ballantyne Co., Omaha, Neb.
●Buffalo Forge Co., Buffalo, N. Y.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
Coolmaster Corp., Chicago, Ill. (Evaporative cooling principle, no dehumidifying)
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
Fedders Mfg. Co., Inc., Buffalo, N. Y.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
General Refrigeration Corp., Beloit, Wis.
Hastings Air Conditioning Co., Hastings, Neb.
Howe Ice Machine Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
King Ventilating Co., Owatonna, Minn.
Larkin Coils, Inc., Atlanta, Ga.
Marlo Coil Co., St. Louis, Mo.
Mayflower-Lewis Corp., St. Paul, Minn.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, Moline, Ill.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Peerless of America, Inc., Chicago, Ill.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
●Refrigeration Economics Co., Inc., Canton, O.
●Rempe Co., Chicago, Ill.
●St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Simmons Co., Gordon H., Milwaukee, Wis.
Thermal Units Mfg. Co., Div. of Air Devices Corp., Meriden, Conn.
●Trane Co., LaCrosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
●Unit Heater & Cooler Co., Wausau, Wis.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

COOLING COILS

See Surface, Cooling

COOLING SURFACE

See Surface, Cooling

COOLING TOWERS

See Towers, Cooling

COOLING UNITS

See Units, Air Conditioning, Industrial Processing, Cooling and Dehumidifying

COPPER PIPE

See Pipe, Copper

COPPER SHEETS

See Sheets, Copper

COPPER TUBE FITTINGS

See Fittings, Copper Tube

COPPER TUBING

See Tubing, Copper

● Advertisement in this issue. See Index to Advertisers, page 168.

COUNTERS, DUST
Bausch & Lomb Optical Co., Rochester, N. Y.
Service to Industry, West Hartford, Conn.
Willson Products, Inc., Reading, Pa.

COUPLINGS, FLEXIBLE, POWER TRANSMISSION
Ajax Flexible Coupling Co., Westfield, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Flexible Coupling Co., Erie, Pa.
Bartlett Hayward Co., Baltimore, Md.
Blood Brothers, Allegan, Mich. (Universal joints)
Boston Gear Wks., Inc., North Quincy, Mass.
Caldwell Co., W. E., Louisville, Ky.
Certified Flexible Couplings, Inc., New York, N. Y.
Chain Belt Co., Milwaukee, Wis.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Continental Diamond Fibre Co., Newark, Del.
Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.
De Laval Steam Turbine Co., Trenton, N. J.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Dodge Mfg. Co., Mishawaka, Ind.
Flexo Supply Co., Inc., St. Louis, Mo.
Frederick Iron & Steel Co., Frederick, Md.
Guardian Utilities Co., Chicago, Ill.
Jones Foundry Machine Co., W. A., Chicago, Ill.
Kraissl Co., Inc., The, Hackensack, N. J.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
Link-Belt Co., Chicago, Ill.
Lord Mfg. Co., Erie, Pa.
Lovejoy Flexible Coupling Co., Chicago, Ill.
Medart Co., St. Louis, Mo.
Moran Flexible Steam Joint Co., Louisville, Ky.
Morse Chain Co., Ithaca, N. Y.
Poole Foundry & Machine Co., Baltimore, Md.
Shallcross Co., Philadelphia, Pa.
Smith, Inc., Winfield H., Springville, N. Y.
Strong-Scott Mfg. Co., Minneapolis, Minn.
Waldron Corp., John, New Brunswick, N. J.
Whitney Chain & Mfg. Co., The, Hartford, Conn.

COUPLINGS, PIPE
Barco Mfg. Co., Chicago, Ill. (Flexible).
Byers Co., A. M., Pittsburgh, Pa.
Champion Machine & Forging Co., Cleveland, O.
Colonial Alloys Co., Specialties Div., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Dresser Mfg. Co., S. R., Bradford, Pa.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Harrisburg Steel Corp., Harrisburg, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis.
Hatch, George E., New York, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jefferson Union Co., Lexington, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
Malleable Iron Fittings Co., Branford, Conn.
Mueller Brass Co., Port Huron, Mich.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ravena Iron Co., Ravena, N. Y. (Cast iron).
●Republic Steel Corp., Cleveland, O.
Semler Co., Jeannette, Pa.
Standard Auto-Tite Joint Co., Pittsburgh, Pa.
Stockham Pipe Fittings Co., Birmingham, Ala.
Stokes Rubber Co., Jos., Trenton, N. J. (Hard rubber).
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Taylor Forge & Pipe Wks., Chicago, Ill.
Victaulic Co. of America, New York, N. Y.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
●Watson-Stillman Co., Roselle, N. J.
Weatherhead Co., Cleveland, O.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

CUTTERS, PIPE
American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Barnes Tool Co., The, New Haven, Conn.
Beaver Pipe Tools, Inc., Warren, O.
●Crane Co., Chicago, Ill.
Crown Die & Tool Co., Chicago, Ill.
Erie Tool Works, Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
International Nutyp Tool Corp., Oswego, N. Y.
Jarecki Mfg. Co., Erie, Pa.
Nye Tool & Machine Works, The, Chicago, Ill.
Ridge Tool Co., Elyria, O.
Sac Tool Mfg. Co., St. Louis, Mo.
Toledo Pipe Threading Machine Co., Toledo, O.
Trimont Mfg. Co., Boston, Mass.
Vanderman Mfg. Co., Willimantic, Conn.
Wallace Supplies Mfg. Co., Chicago, Ill.
Weatherhead Co., Cleveland, O.

CUTTERS, TUBING
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Barnes Tool Co., The, New Haven, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Greenfield Tap & Die Corp., Greenfield, Mass.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Mueller Brass Co., Port Huron, Mich.
Nye Tool & Machine Works, The, Chicago, Ill.
Parker Appliance Co., Cleveland, O.
Ridge Tool Co., Elyria, O.
Sac Tool Mfg. Co., St. Louis, Mo.
Toledo Pipe Threading Machine Co., Toledo, O.
Trimont Mfg. Co., Boston, Mass.

DAMPER OPERATORS
See Operators, Damper

DAMPER QUADRANTS
See Quadrants, Damper

DAMPERS, DUCT
Air Conditioning Products Co., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American Warming & Ventilating Co., Toledo, O.
Anemostat Corp. of America, New York, N. Y.
Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Brown, Wm. P., Springfield, Mass.
Chicago Metal Mfg. Co., Chicago, Ill.
Elgo Shutter & Mfg. Co., Detroit, Mich.
Gillian Mfg. Co., Ferndale, Mich.
Hampden Cornice Wks., Inc., Springfield, Mass.
●Hart & Cooley Mfg. Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
●Henry Furnace & Foundry Co., Cleveland, O.
Iona Ventilator Co., Inc., Philadelphia, Pa.
Jacobs Co., B. & J., Cincinnati, O.
Jordan & Co., Paul R., Indianapolis, Ind.
King Ventilating Co., Owatonna, Minn.
Lennox Furnace Co., Marshalltown, Ia., and Syracuse, N. Y.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Strandwitz & Co., Inc., W. J., Camden, N. J.
●Tuttle & Bailey, Inc., New Britain, Conn.
United States Register Co., Battle Creek, Mich.
Young Regulator Co., Cleveland, O.

DAMPERS, REMOTE CONTROLLED
Atlas Valve Co., Inc., Newark, N. J.
Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Brooke Engineering Co., Inc., Philadelphia, Pa.
d'Este Co., Julian, Charlestown, Mass.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.
R-S Products Corp., Philadelphia, Pa.
Young Regulator Co., Cleveland, O.

DEAERATORS
●Cochrane Corp., Philadelphia, Pa.
Croll-Reynolds Engrg. Co., Inc., New York, N. Y.
Elliott Co., Jeannette, Pa.
Hagan Corp., Pittsburgh, Pa.
Hoppes Mfg. Co., Springfield, O.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.

DEEP WELL PUMPS
See Pumps, Deep Well

DEHUMIDIFIERS, ABSORPTION AND ADSORPTION
Air & Refrigeration Corp., New York, N. Y.
American Injector Co., Detroit, Mich.
Bryant Heater Co., The, Cleveland, O. (Silica gel)
●Carrier Corp., Syracuse, N. Y.
Lamson Co., Inc., Syracuse, N. Y.
Mayflower-Lewis Corp., St. Paul, Minn.
Pittsburgh Lectrodryer Corp., Pittsburgh, Pa.
Research Corp., New York, N. Y.
Simmons Co., Gordon H., Milwaukee, Wis.
Surface Combustion Corp., Toledo, O.
●Trane Co., La Crosse, Wis.

DEHUMIDIFYING UNITS
See Units, Air Conditioning, Industrial Processing, Cooling and Dehumidifying

DETECTORS, LEAK, REFRIGERANT
Bernz Co., Inc., Otto, Rochester, N. Y.
Clayton & Lambert Mfg. Co., Detroit, Mich.

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Hull Mfg. Co., Hagerstown, Md.
●Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Turner Brass Wks., Sycamore, Ill.

DIAPHRAGM VALVES

See Valves, Diaphragm

DIESEL ENGINES

See Engines, Diesel for Fan, Pump and Compressor Drives

DIFFUSERS, AIR

American Foundry & Furnace Co., Bloomington, Ill.
Anemostat Corp. of America, New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Supreme Heater & Ventilating Corp., St. Louis, Mo.
●Waterloo Register Co., Waterloo, Ia.

DOORS AND PANELS, ACCESS

American Foundry & Furnace Co., Bloomington, Ill.
●Auer Register Co., Cleveland, O.
●Clarage Fan Co., Kalamazoo, Mich.
Falstrom Co., Passaic, N. J.
Higgin Products, Inc., Newport, Ky.
Kirk & Blum Mfg. Co., Cincinnati, O.
Lawson Co., F. H., Cincinnati, O.
Milcor Steel Co., Milwaukee, Wis.
Rock Island Register Co., Rock Island, Ill.
Truscon Steel Co., Youngstown, O.
●Tuttle & Bailey, Inc., New Britain, Conn.
Walsh-Spencer Co., Boston, Mass.
Way Panel Loctor Co., Wollaston, Mass.

DOORS, REVOLVING

Atchison Revolving Door Co., Independence, Kans.
General Bronze Corp., Long Island City, N. Y.
Revolving Doors, Inc., New York, N. Y.
Newman Brothers, Inc., Cincinnati, O.
Van Kannel Revolving Door Co., New York, N. Y.

DRAFT GAGES

See Gages, Indicating, Draft

DRAFT RECORDERS

See Recorders, Draft

DRAFT REGULATORS

See Regulators, Draft

DRILLS, PORTABLE, ELECTRIC

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., New York, N. Y.
Independent Pneumatic Tool Co., Chicago, Ill.
Millers Falls Co., Greenfield, Mass.
Snap-On Tools Corp., Kenosha, Wis.
Speedway Mfg. Co., Chicago (Cicero), Ill.
Stanley Wks., New Britain, Conn.
Skilsaw, Inc., Chicago, Ill.
U. S. Electrical Tool Co., Cincinnati, O.

DRIVES, CHAIN

Boston Gear Works, Inc., North Quincy, Mass.
Caldwell Co., W. E., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Medart Co., St. Louis, Mo.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Whitney Chain & Mfg. Co., The, Hartford, Conn.

DRIVES, FLAT BELT

See also Belting, Leather and Belting, Rubber

American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co. Inc., Ohio Valley Pulley Works Div., Maysville, Ky.
Caldwell Co., W. E., Louisville, Ky.
Chicago Belting Co., Chicago, Ill.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Dick Co., Inc., R. & J., Passaic, N. J.
Medart Co., St Louis, Mo.
Rockwood Mfg. Co., Indianapolis, Ind.
Smith, Inc., Winfield H., Springville, N. Y.
Wood's Sons Co., T. B., Chambersburg, Pa.

DRIVES, V BELT

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Boston Gear Wks., Inc., North Quincy, Mass.
Browning Mfg. Co., Inc., Ohio Valley Pulley Works Div., Maysville, Ky.
Chicago Belting Co., Chicago, Ill.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J.
Dodge Mfg. Co., Mishawaka, Ind.
Gates Rubber Co., Denver, Colo.
Goodrich Co., B. F., Akron, O.
Horton Mfg. Co., Minneapolis, Minn.
Jones Foundry Machine Co., W. A., Chicago, Ill.
Medart Co., St. Louis, Mo.
Pyott Foundry & Machine Co., Chicago, Ill.
Rockwood Mfg. Co., Indianapolis, Ind.
Smith, Inc., Winfield H., Springville, N. Y.
Wood's Sons Co., T. B., Chambersburg, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

DUAL THERMOSTATS

See Thermostats, Two Temperature or Dual

DUCT DAMPERS

See Dampers, Duct

DUCT HEATERS

See Heaters, Duct, Electric

DUCT INSULATION

See Insulation, Duct

DUCT THERMOSTATS

See Thermostats, Duct Type

DUCTS AND DUCT FITTINGS, PREFABRICATED

Acer & Whedon, Medina, N. Y.
Acme Tin Plate & Roofing Supply Co., Philadelphia, Pa.
Carey Co., Philip, Cincinnati, O.
Chicago Metal Mfg. Co., Chicago, Ill.
Cincinnati Sheet Metal & Roofing Co., Cincinnati, O.
Excelsior Steel Furnace Co., Chicago, Ill.
●Henry Furnace & Foundry Co., Cleveland, O.
Jacobs Co., B. & J., Cincinnati, O.
Lamneck Products, Inc., Columbus, O.
Lennox Furnace Co., Marshalltown, Ia.
Mellish & Murray Co., Chicago, Ill.
Meyer & Bro. Co., F., Peoria, Ill.
Milcor Steel Co., Milwaukee, Wis.
Moncrief Furnace Co., Atlanta, Ga.
Richmond Radiator Co., Uniontown, Pa.
Robertson Co., H. H., Pittsburgh, Pa.
●Waterloo Register Co., Waterloo, Ia. (Corner turns).

DUST COLLECTORS

See Collectors, Dust

DUST COUNTERS

See Counters, Dust

EJECTORS, SEWAGE

American-Marsh Pumps, Inc., Battle Creek, Mich.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Works Co., Columbus, O.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Economy Pumps, Inc., Chicago, Ill.
●Nash Engineering Co., South Norwalk, Conn.
Penberthy Injector Co., Detroit, Mich.
Quimby Pump Co., Inc., Newark, N. J.
Taber Pump Co., Buffalo, N. Y.
Weil Pump Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

ELECTRIC DRILLS

See Drills, Portable, Electric

ELECTRIC MOTORS

See Motors, Electric

ELECTRIC SHEARS

See Shears, Electric, Portable

ELECTRIC UNIT HEATERS

See Heaters, Unit, Electric

ELECTRICAL AIR CLEANERS

See Cleaners, Air, Electrical

ELECTRODES, ARC WELDING

American Chain & Cable Co., Inc., Bridgeport, Conn.
American Steel & Wire Co., Cleveland, O.
Commonwealth Mfg. Corp., Cincinnati, O.
General Electric Co., Schenectady, N. Y.
Hobart Bros., Troy, O.
Lincoln Electric Co., Cleveland, O.
Marquette Mfg. Co., Minneapolis, Minn.
Maurath, Inc., Cleveland, O.
McKay Co., Pittsburgh, Pa.
Page Steel & Wire Division of American Chain Co., Inc., Monessen, Pa.
Roebling's Sons, John A., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Una Welding, Inc., E. Cleveland, O.
Universal Power Corp., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wilson Welder & Metals Co., Inc., New York, N. Y.

ELIMINATORS, AIR, FOR HEATING SYSTEMS

American Radiator Co., New York, N. Y.
Anderson Products, Inc., Cambridge, Mass.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
●Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.

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●Maid-O-Mist, Inc., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
●Sarco Co., Inc., New York, N. Y.
Sterling Engineering Co., Milwaukee, Wis.
●Trane Co., La Crosse, Wis.
●Webster & Co., Warren, Camden, N. J.

ENAMELS AND LACQUERS

Debevoise Co., Brooklyn, N. Y.
du Pont de Nemours & Co., E. I., Fabrics & Finishes Dept., Wilmington, Del.
Hilo Varnish Corp., Brooklyn, N. Y.
Inter-Coastal Paint Corp., East St. Louis, Ill.
Maas & Waldstein Co., Newark, N. J.
Wailes Dove-Hermiston Corp., New York, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Zapon-Brevolite Div., Atlas Powder Co., North Chicago, Ill.

ENGINES, DIESEL, FOR FAN, PUMP AND COMPRESSOR DRIVES

American Locomotive Co., Auburn, N. Y.
Anderson Engine & Foundry Co., Anderson, Ind.
Buda Co., Harvey, Ill.
Caterpillar Tractor Co., Peoria, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
De La Vergne Engine Co., Philadelphia, Pa.
General Motors Corp., Detroit, Mich.
Fairbanks, Morse & Co., Chicago, Ill.
Hill Diesel Engine Co., Lansing, Mich.
Ingersoll-Rand, New York, N. Y.
Waukesha Motor Co., Waukesha, Wis.
●Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES, GAS, FOR FAN, PUMP AND COMPRESSOR DRIVES

Bardco Corp. of America, Los Angeles, Cal.
Chicago Pneumatic Tool Co., New York, N. Y.
Continental Motors Corp., Detroit, Mich.
Fairbanks, Morse & Co., Chicago, Ill.
Lycoming Mfg. Co., Williamsport, Pa.
U. S. Motors Corp., Oshkosh, Wis.
Universal Motor Co., Oshkosh, Wis.
Waukesha Motor Co., Waukesha, Wis.
●Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES, STEAM, FOR FAN, PUMP AND COMPRESSOR DRIVES

Ames Iron Wks., Div. of Pierce, Butler Radiator Corp., Oswego, N. Y.
Elliott Co., Jeannette, Pa.
●Frick Co., Waynesboro, Pa.
Harrisburg Fdry. & Mach. Co., Inc., Harrisburg, Pa.
Morris Machine Wks., Baldwinsville, N. Y.
Murray Iron Wks. Co., Burlington, Ia.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Skinner Engine Co., Erie, Pa.
Sturtevant Co., B. F., Boston, Mass.
Troy Engine & Machine Co., Troy, Pa.
●Vilter Mfg. Co., Milwaukee, Wis.

EVAPORATIVE CONDENSERS

See Condensers, Evaporative

EXCHANGERS, HEAT

Acme Industries, Inc., Jackson, Mich.
Alco Products, Div. of American Locomotive Co., New York, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●American District Steam Co., North Tonawanda, N. Y.
●Baker Ice Machine Co., Omaha, Neb.
●Cochrane Corp., Philadelphia, Pa.
Cooling Tower Co., Inc., The, Div. of The Fluor Corp., Ltd., New York, N. Y.
Davis Engineering Corp., Elizabeth, N. J.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Drayer & Hanson, Inc., Los Angeles, Cal.
Elgin Softener Corp., Elgin, Ill.
Filtrine Mfg. Co., Brooklyn, N. Y.
Fluor Corp., Ltd., The, Los Angeles, Cal.
Frank Engineering Co., New York, N. Y.
●Frick Co., Waynesboro, Pa.
General Fittings Co., Providence, R. I.
General Refrigeration Corp., Beloit, Wis.
Graham Mfg. Co., Buffalo, N. Y.
Griscom-Russell Co., New York, N. Y.
Howard Iron Wks. & Alberger Heater Co., Buffalo, N. Y.
Johnson Fan & Blower Corp., Chicago, Ill.
Larkin Coils, Inc., Atlanta, Ga.
Lewis & Co., Joseph E., Baltimore, Md.
Manufacturers Fin Coil Co., Chicago, Ill.
McCord Radiator & Mfg. Co., Detroit, Mich.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
●Refrigeration Economics Co., Inc., Canton, O.
Richmond Engineering Co., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Sims Co., Erie, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Superior Valve and Fittings Co., Pittsburgh, Pa.
●Trane Co., LaCrosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.
●Worthington Pump & Machinery Corp., Harrison, N. J.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

EXPANSION BENDS

See Bends, Expansion

EXPANSION BOLTS

See Bolts, Expansion

EXPANSION JOINTS

See Joints, Pipe, Expansion

EXPANSION VALVES

See Valves, Refrigerating

EXTRACTORS, PIPE

Greenfield Tap & Die Corp., Greenfield, Mass.
Reps Tool, Inc., Buffalo, N. Y.
Ridge Tool Co., Elyria, O.

FAN BASES

See Bases and Pads, Vibration Isolating

FAN BLADES

See Blades, Fan

FANS, CENTRIFUGAL

Advance Fan & Blower Co., Detroit, Mich.
Air Controls, Inc., Cleveland, O.
Air Devices Corp., Meriden, Conn.
●Airtherm Mfg. Co., St. Louis, Mo.
Allen Billmyre Corp., New York, N. Y.
American Blower Corp., Detroit, Mich.
Ames Co., W. R., San Francisco, Cal.
Arex Co., Chicago, Ill.
●Autovent Fan & Blower Co., Chicago, Ill.
Ballantyne Co., Omaha, Nebr.
Bayley Blower Co., Milwaukee, Wis.
Berns Specialty Co., Chicago, Ill.
Bishop & Babcock Mfg. Co., Cleveland, O.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., Des Moines, Ia.
Campbell Heating Co., E. K., Kansas City, Mo.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
Columbus Heating & Ventilating Co., Columbus, O.
Coppus Engineering Corp., Worcester, Mass.
Davidson Hy Duty Roof Fan Co., Newton, Mass.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Duriron Co., Inc., Dayton, O., (Acid resisting).
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
●Garden City Fan Co., Chicago, Ill.
General Blower Co., Inc., Philadelphia, Pa.
Hastings Air Conditioning Co., Hastings, Neb.
Ilg Electric Ventilating Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
Jordan & Co., Paul R., Indianapolis, Ind.
King Ventilating Co., Owatonna, Minn.
Lehigh Fan & Blower Co., Allentown, Pa.
Lennox Furnace Co., Marshalltown, Ia.
Lohman, Inc., Wm. J., New York, N. Y.
Mechanical Air, Little Rock, Ark.
Montag Stove & Furnace Wks., Portland, Ore.
Mountain States Equipment Co., Denver, Colo.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
New York Blower Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Northern Blower Co., Cleveland, O.
Pangborn Corp., Hagerstown, Md.
Peerless Electric Co., Warren, O.
Schwitzer-Cummins Co., Indianapolis, Ind.
Smith Heater Co., Peter, Detroit, Mich.
Stilphen Engineering & Mfg. Co., C. A., Denver, Colo.
Sturtevant Co., B. F., Boston, Mass.
Supreme Heater & Ventilating Corp., Bonner Springs, Kans.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Viking Air Conditioning Corp., Cleveland, O.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.

FANS, PROPELLER

Aerovent Fan Co, Piqua, O.
Air Controls, Inc., Cleveland, O.
Aircraft Mfg. Co., Dayton, O.
Air Devices Corp., Meriden, Conn.
Airmaster Corp., Chicago, Ill.
●Airtherm Mfg. Co., St. Louis, Mo.
Allen Corp., Detroit, Mich.

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American Blower Corp., Detroit, Mich.
American Coolair Corp., Jacksonville, Fla.
Ames Co., W. R., San Francisco, Cal.
Arex Co., Chicago, Ill.
●Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Belanger Fan & Oven Co., Detroit, Mich.
Belco Exhaust Fan Mfg. Co., St. Louis, Mo.
Bendix Products Corp., South Bend, Ind.
Berns Specialty Co., Chicago, Ill.
Binks Mfg. Co., Chicago, Ill.
Bishop & Babcock Mfg. Co., Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., New York, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Coppus Engineering Corp., Worcester, Mass.
Dallas Engineering Co., Inc., Dallas, Tex.
Davenport Mfg. Co., Meadville, Pa.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Diehl Mfg. Co., Elizabeth, N. J.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Fresh'nd-Aire Co., Chicago, Ill.
●Garden City Fan Co., Chicago, Ill.
General Blower Co., Inc., Philadelphia, Pa.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Hartzell Propeller Fan Co., Piqua, O.
●Henry Furnace & Foundry Co., Cleveland, O.
Ilg Electric Ventilating Co., Chicago, Ill.
International Engineering, Inc., Dayton, O.
Johnson Fan & Blower Corp., Chicago, Ill.
Johnston Co., William W., Dayton, O.
Jordan & Co., Paul R., Indianapolis, Ind.
King Ventilating Co., Owatonna, Minn.
Kisco Co., Inc., St. Louis, Mo.
Lohman, Inc., Wm. J., New York, N. Y.
Marathon Electric Mfg. Corp., Wausau, Wis.
Mechanical Air, Little Rock, Ark.
Meier Electric & Machine Co., Indianapolis, Ind.
Mountain States Equipment Co., Denver, Colo.
Myers Electric Co., Pittsburgh, Pa.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
New York Blower Co., Chicago, Ill.
Norwin Co., Freeport, Ill.
Peerless Electric Co., Warren, O. (Disc).
Perkins & Son, Inc., B. F., Holyoke, Mass.
Propellair, Inc., Springfield, O.
Reed Unit-Fans, Inc., New Orleans, La.
Robbins & Myers, Inc., Springfield, O.
Russell Electric Co., Chicago, Ill.
Schwitzer-Cummins Co., Indianapolis, Ind.
South Bend Air Products Corp., South Bend, Ind.
Stilphen Engineering & Mfg. Co., C. A., Denver, Colo.
Sturtevant Co., B. F., Boston, Mass.
Utility Fan Corp., Los Angeles, Cal.
Vallen, Inc., Akron, O.
Viking Air Conditioning Corp., Cleveland, O.
Western Blower Co., Seattle, Wash.
Western Engineering & Mfg. Co., Los Angeles, Cal.
●Wing Mfg. Co., L. J., New York, N. Y.

FEEDERS, WATER, HEATING BOILER

Beaton & Cadwell Mfg Co., New Britain, Conn.
Cissell Mfg. Co., W. M., Louisville, Ky.
Davis Regulator Co., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Foster Wheeler Corp., New York, N. Y.
Healy Ruff Co., St. Paul, Minn.
Kisco Co., Inc., St. Louis, Mo.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
●Maid-O-Mist, Inc., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
●Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Milwaukee Valve Co., Milwaukee, Wis.
Mueller Steam Specialty Co., Inc., New York, N. Y.
Nason Co., Detroit, Mich.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Whitlock Coil Pipe Co., Hartford, Conn.
●Worthington Pump & Machinery Corp., Harrison, N. J.

FIBRE PACKING

See Packing, Fibre

FILTER GAGES

See Gages, Air Filter

FILTERS, AIR, AUTOMATIC

American Air Filter Co., Inc., Louisville, Ky.
Amirton Co., New York, N. Y.
Coppus Engineering Corp., Worcester, Mass.
Dracco Corp., Cleveland, O.
Hugo Mfg. Co., West Duluth, Minn.
●Independent Air Filter Co., Chicago, Ill.
Northern Blower Co., Cleveland, O.
Staynew Filter Corp., Rochester, N. Y.

FILTERS, AIR, UNIT, CLEANABLE

●Air-Maze Corp., Cleveland, O.
American Air Filter Co., Inc., Louisville, Ky.
Amirton Co., New York, N. Y.
Annis Air Filters, Glendale, Cal.
Coppus Engineering Corp., Worcester, Mass.
Hugo Mfg. Co., West Duluth, Minn.
●Independent Air Filter Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kleenaire Corp., Stevens Point, Wis.
Kraissl Co., Inc., The, Hackensack, N. J.
●Somers, Inc., H. J., Detroit, Mich.
Staynew Filter Corp, Rochester, N. Y.

FILTERS, AIR, UNIT, THROW-AWAY

American Air Filter Co., Inc., Louisville, Ky.
●American Radiator Co., New York, N. Y.
Amirton Co., New York, N. Y.
Anderson Products, Inc., Cambridge, Mass.
Blocksom & Co., Michigan City, Ind.
Chicago Air Filter Co., Joliet, Ill.
Davies Air Filter Corp., New York, N. Y.
●Independent Air Filter Co., Chicago, Ill.
Kleenaire Corp., Stevens Point, Wis.
Owens-Corning Fiberglas Corp., Toledo, O.
Plymouth Cordage Co., N. Plymouth, Mass.; Anderson Products, Inc., Cambridge, Mass. National Sales Agents.
Research Products Corp., Madison, Wis.
●Somers, Inc., H. J., Detroit, Mich.
Staynew Filter Corp., Rochester, N. Y.
Supreme Air Filter Co., New York, N. Y.
Universal Air Filter Corp., Duluth, Minn.
Wilson & Co., Chicago, Ill.

FILTERS, PIPE LINE

Adams Co., R. P., Buffalo, N. Y.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Cuno Engineering Corp., Meriden, Conn.
Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
Fisher Governor Co., Marshalltown, Ia.
Johnson Corp., Three Rivers, Mich.
Mason-Neilan Regulator Co., Boston, Mass.
Mueller Brass Co., Port Huron, Mich.
Norwood Engineering Co., The, Florence, Mass.
Permutit Co., New York, N. Y.
Refinite Corp., Omaha, Neb.

FINNED TUBING

See Tubing, Finned

FIRE PUMPS

See Pumps, Fire

FITTINGS, COPPER TUBE, COMPRESSION

●American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
Chase Brass & Copper Co., Waterbury, Conn.
Colonial Alloys Co., Specialties Div., Philadelphia, Pa.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Dole Valve Co., Chicago, Ill.
Dresser Mfg. Co., S. R., Bradford, Pa.
Hays Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
●Revere Copper & Brass, Inc., New York, N. Y.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Union Metal Wks., Inc., Chelsea, Mass.
Weatherhead Co., Cleveland, O.

FITTINGS, COPPER TUBE, SOLDER

●American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
American Radiator Co., New York, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
●Revere Copper & Brass, Inc., New York, N. Y.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Superior Valve and Fittings Co., Pittsburgh, Pa.
Union Metal Wks., Inc., Chelsea, Mass.
Weatherhead Co., Cleveland, O.
Wolverine Tube Co., Detroit, Mich.

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FITTINGS, LINED

Goodrich Co., B. F., Akron, O. (Rubber)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead and tin)
National Lead Co., New York, N. Y. (Lead)
Northern Indiana Brass Co., Elkhart, Ind. (Tinned)
Resisto Pipe & Valve Co., East Cambridge, Mass.
United States Rubber Co., New York, N. Y. (Rubber)

FITTINGS, PIPE, BRASS, SOLDER

Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
Hussey & Co., C. G., Pittsburgh, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Union Metal Wks., Inc., Chelsea, Mass.
Walworth Co., New York, N. Y. (Brazed)
Wolverine Tube Co., Detroit, Mich.

FITTINGS, PIPE, BRASS, THREADED

Acheson Mfg. Co., Rankin, Pa.
American Manganese Bronze Co., Philadelphia, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Commnowealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co., Providence, R. I.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Hussey & Co., C. G., Pittsburgh, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Mfg. Co., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
Mueller Brass Co., Port Huron, Mich.
New York Brass Fdry., New York, N. Y.
Northern Indiana Brass Co., Elkhart, Ind.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Union Metal Wks., Inc., Chelsea, Mass.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
Weatherhead Co., Cleveland, O.

FITTINGS, PIPE, BRASS, WELDING

Bonney Forge & Tool Wks., Allentown, Pa.
●Tube-Turns, Inc., Louisville, Ky.

FITTINGS, PIPE, CAST IRON, FLANGED

American Cast Iron Pipe Co., Birmingham, Ala.
Clow & Sons, Jas. B., Chicago, Ill.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kuhns Bros. Co., Dayton, O.
Lumsden & Van Stone Co., South Boston, Mass.
National Valve & Mfg. Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Semler Co., Jeannette, Pa.
Somerville Iron Works, Somerville, N. J.
Stockham Pipe Fittings Co., Birmingham, Ala.
Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

FITTINGS, PIPE, CAST IRON, THREADED

●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kuhns Bros. Co., Dayton, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ravena Iron Co., Ravena, N. Y.
Semler Co., Jeannette, Pa.
Somerville Iron Works, Somerville, N. J.
Stockham Pipe Fittings Co., Birmingham, Ala.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

FITTINGS, PIPE, LEAD

Andrews Lead Co., Inc., Long Island City, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.

FITTINGS, PIPE, MALLEABLE

●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Dresser Mfg. Co., S. R., Bradford, Pa.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co., Providence, R. I.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jefferson Union Co., Lexington, Mass.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Malleable Iron Fittings Co., Branford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Stockham Pipe Fittings Co., Birmingham, Ala.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

FITTINGS, PIPE, STEEL, FLANGED

Alloy Steel Products Co., Linden, N. J. (Stainless steel).
●American Rolling Mill Co., Middletown, O.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Thos., Burlington, N. J.
National Valve & Mfg. Co., Pittsburgh, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Semet-Solvay Engrg. Corp., New York, N. Y.
Taylor Forge & Pipe Wks., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.

FITTINGS, PIPE, STEEL, SOCKET WELD

Central Forging Co., Catawissa, Pa.
Taylor Forge & Pipe Wks., Chicago, Ill.
●Watson-Stillman Co., Roselle, N. J.

FITTINGS, PIPE, STEEL, THREADED

Alloy Steel Products Co., Linden, N. J., (Stainless steel).
Central Forging Co., Catawissa, Pa.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Thos., Burlington, N. J.
Harrisburg Steel Corp., Harrisburg, Pa.
Laclede Steel Co., St. Louis, Mo.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.

FITTINGS, PIPE, STEEL, WELDING

●American Rolling Mill Co., Middletown, O.
Bonney Forge & Tool Wks., Allentown, Pa.
Central Forging Co., Catawissa, Pa.
●Crane Co., Chicago, Ill.
●Grinnell Co., Inc., Providence, R. I.
Larkin Packer Co., St. Louis, Mo.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Valve & Mfg. Co., Pittsburgh, Pa.
Oil Well Supply Co., Oil City, Pa.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Semet-Solvay Engineering Corp., New York, N. Y.
Taylor Forge & Pipe Wks., Chicago, Ill.
●Tube-Turns, Inc., Louisville, Ky.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
Wedge Protectors, Inc., Cleveland, O. (Chill rings)

FITTINGS, PIPE, WROUGHT IRON, WELDING

Bonney Forge & Tool Wks., Allentown, Pa.
Byers Co., A. M., Pittsburgh, Pa.
●Grinnell Co., Inc., Providence, R. I.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Valve & Mfg. Co., Pittsburgh, Pa.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Taylor Forge & Pipe Wks., Chicago, Ill.
Walworth Co., New York, N. Y.

FITTINGS, REFRIGERATION

Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
Henry Valve Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kerotest Mfg. Co., Pittsburgh, Pa.
Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
Perfection Refrigeration Parts Co., Harvey, Ill.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.

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Superior Valve and Fittings Co., Pittsburgh, Pa.
Triumph Ice Machine Co., Cincinnati, O.
●Vilter Mfg. Co., Henry, Louisville, Ky.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.
Weatherhead Co., Cleveland, O.
Wittenmeier Machinery Co., Chicago, Ill.
●Worthington Pump & Machinery Corp., Harrison, N. J.
X L Refrigerating Co., Inc., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

FLANGE BOLTS

See Bolts and Studs, Flange

FLANGES, PIPE

American Cast Iron Pipe Co., Birmingham, Ala.
●American Rolling Mill Co., Middletown, O.
Blaw-Knox Co., Blawnox, Pa.
Clow & Sons, Jas. B., Chicago, Ill.
●Crane Co., Chicago, Ill.
●Dart Mfg. Co., E. M., Providence, R. I.
Devlin Mfg. Co., Thos., Burlington, N. J.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Harrisburg Steel Corp., Harrisburg, Pa.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Mfg. Co., New York, N. Y. (Brass only)
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kuhns Bros. Co., Dayton, O.
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden & Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Valve & Mfg. Co., Pittsburgh, Pa.
Pennsylvania Forge Co., Philadelphia, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Pittsburgh Valve Foundry & Construction Co., Pittsburgh, Pa.
Ravena Iron Co., Ravena, N. Y.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Semler Co., Jeannette, Pa.
Steel Improvement & Forge Co., Cleveland, O.
Stokes Rubber Co., Jos., Trenton, N. J. (Hard rubber)
Taylor Forge & Pipe Wks., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
Warren Foundry & Pipe Corp., New York, N. Y.

FLEXIBLE COUPINGS

See Couplings, Flexible

FLEXIBLE METAL HOSE

See Hose, Metal, for Eliminating Compressor Vibration

FLOATS, STEAM TRAP, ETC.

●Anderson Co., V. D., The, Cleveland, O.
Clark Controller Co., Cleveland, O.
Cryer Trap & Valve Co., Inc., New York, N. Y.
d'Este Co., Julian, Charlestown, Mass.
Fisher Governor Co., Marshalltown, Ia.
Harris & Co., Arthur, Chicago, Ill.
Hercules Float Wks., Springfield, Mass.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
McAlear Mfg. Co., Chicago, Ill.
Naugatuck Mfg. Co., Union City, Conn.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Reichert Float & Mfg. Co., Toledo, O.
Reliance Gauge Column Co., Cleveland, O.
Sterling Engineering Co., Milwaukee, Wis.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Watson & McDaniel Co., 440 N. Marshall, Philadelphia, Pa.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

FLOAT SWITCHES

See Switches, Float

FLOAT VALVES

See Valves, Float

FLOOR AND CEILING PLATES

See Plates, Floor and Ceiling

FLOW METERS

See Meters, Flow

FORGED STEEL VALVES

See Valves, Forged Steel

FURNACES, WARM AIR, FOR INDUSTRIAL AND LARGE BUILDING HEATING

Acme Heating & Ventilating Co., Inc., Chicago, Ill.
●Airtherm Mfg. Co., St. Louis, Mo.
American Foundry & Furnace Co., Bloomington, Ill.
Campbell Heating Co., Des Moines, Ia.
Campbell Heating Co., E. K., Kansas City, Mo.
Forest City Foundries Co., Cleveland, O.
Hart & Crouse Corp., Utica, N. Y.
●Henry Furnace & Foundry Co., Cleveland, O.
International Heater Co., Utica, N. Y.
Jackson & Church Co., Saginaw, Mich.
Lee Heating Systems, Youngstown, O.
Lennox Furnace Co., Marshalltown, Ia., and Syracuse, N. Y.
Magirl Foundry & Furnace Wks., P. H., Bloomington, Ill.
Moncrief Furnace Co., Atlanta, Ga.
Montag Stove & Furnace Wks., Portland, Ore.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Nelson Co., Detroit, Mich.
New York Blower Co., Chicago, Ill.
Nugent Sons, Inc., Thos., New York, N. Y.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Ross Engineering Corp., J. O., New York, N. Y.
Smith, Inc., James Campbell, Cleveland, O.
Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.
Surface Combustion Corp., Toledo, O.
Western Furnaces, Inc., Tacoma, Wash.
Williams, Inc., F. C., Dearborn, Mich.
XXth Century Heating & Ventilating Co., Akron, O.

GAGES, AIR FILTER

American Air Filter Co., Inc., Louisville, Ky. (Whistling device)
Detroit Air Meter Co., Detroit, Mich.
Ellison Draft Gage Co., Chicago, Ill.
Friez & Sons, Julien P., Baltimore, Md.
Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.

GAGES, INDICATING, DRAFT

Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Crew-Equipment Co., Inc., New York, N. Y.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Ellison Draft Gage Co., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Meriam Co., The, Cleveland, O.
Moeller Instrument Co., Richmond Hill, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Spence Engrg. Co., Inc., Walden, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Uehling Instrument Co., Paterson, N. J.

GAGES, INDICATING, PRESSURE

Anderson Products, Inc., Cambridge, Mass.
Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Belfield Co., H., Philadelphia, Pa.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Brunner Mfg. Co., Utica, N. Y.
Builders Iron Foundry, Providence, R. I.
●Crane Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Lonergan Co., J. E., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Meriam Co., The, Cleveland, O.
Moeller Instrument Co., Richmond Hill, N. Y.
Mouat Vapor Heating Co., The, Cleveland, O.
Parker Appliance Co., Cleveland, O.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Russell & Co., W. A., New York, N. Y.
Sterling Engineering Co., Milwaukee, Wis.
●Taylor Instrument Companies, Rochester, N. Y.
●Trane Co., La Crosse, Wis.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

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GAGES, INDICATING, VACUUM

Anderson Products, Inc., Cambridge, Mass.
Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Belfield Co., H., Philadelphia, Pa.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Dole Valve Co., Chicago, Ill.
●Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
General Electric Co., Schenectady, N. Y.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Lonergan Co., J. E., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Meriam Co., The, Cleveland, O.
Moeller Instrument Co., Richmond Hill, N. Y.
Mouat Vapor Heating Co., The, Cleveland, O.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Russell & Co., W. A., New York, N. Y.
Sterling Engineering Co., Milwaukee, Wis.
●Taylor Instrument Companies, Rochester, N. Y.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

GAGES, LIQUID LEVEL

Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Boston Auto Gage Co., Pittsfield, Mass.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Caldwell Co., W. E., Louisville, Ky.
●Crane Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Lubricator Co., Detroit, Mich.
Diamond Power Specialty Corp., Detroit, Mich.
Foxboro Co., Foxboro, Mass.
●Frick Co., Waynesboro, Pa.
Hays Corp., Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Keckley Co., O. C., Chicago, Ill.
King-Seeley Corp., Ann Arbor, Mich.
Klingerit, Inc., New York, N. Y.
Liquidometer Corp., Long Island City, N. Y.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
Meriam Co., The, Cleveland, O.
Nason Co., Detroit, Mich.
Norwood Engineering Co., The, Florence, Mass.
Petrometer Corp., Long Island City, N. Y.
Reliance Gauge Column Co., Cleveland, O.
Republic Flow Meters Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
Superior Valve and Fittings Co., Pittsburgh, Pa.
●Taylor Instrument Companies, Rochester, N. Y.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.
Viking Pump Co., Cedar Falls, Ia.
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.

GALVANIZED SHEETS

See Sheets, Steel, Galvanized

GAS ANALYZERS

See Analyzers, Gas

GAS BURNERS

See Burners, Gas

GAS ENGINES

See Engines, Gas

GAS PRESSURE REGULATORS

See Regulators, Pressure, Gas

GASKETS

Akron Metallic Gasket Co., Akron, O. (Metal & metal asbestos)
Anchor Packing Co., Philadelphia, Pa. (Asbestos)
●Armstrong Cork Co., Lancaster, Pa. (Cork & cork composition)
Azor Corp., Newark, N. J. (Spiral wound)
Butterworth, Jr., B. T., New Canaan, Conn. (Cork)
Chicago-Wilcox Mfg. Co., Chicago, Ill.
Continental Diamond Fibre Co., Newark, Del.
Continental Rubber Wks., Erie, Pa.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y. (Asbestos)
Durabla Mfg. Co., New York, N. Y. (Asbestos fibre)
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Endura Mfg. Corp., Quakertown, Pa. (Paper, fibre)
Excelsior Leather Washer Co., Rockford, Ill.
Felt Products Mfg. Co., Chicago, Ill. (Heat and oil resisting)
Flexatallic Gasket Co., Camden, N. J. (Metal, asbestos)
●Frick Co., Waynesboro, Pa.
Garlock Packing Co., Palmyra, N. Y. (Rubber, asbestos, fibre, semi-metallic)
Gatke Corp., Chicago, Ill.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Goodrich Co., B. F., Akron, O. (Rubber, asbestos, synthetics)
Graton & Knight Co., Worcester, Mass. (Leather)
Houghton & Co., E. F., Philadelphia, Pa. (Leather)
Hussey & Co., C. G., Pittsburgh, Pa. (Copper)
●Jenkins Bros., New York, N. Y. (Ring asbestos or rubber sheet)
Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
Klingerit, Inc., New York, N. Y.
Manhattan Rubber Mfg., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Metallo Gasket Co., New Brunswick, N. J. (Metal, metal asbestos)
Mitchell & Smith, Inc., Detroit, Mich. (Cork)
National Boiler Improvement Co., Washington, D. C.
Ruberoid Co., New York, N. Y. (Asbestos)
Smooth-On Mfg. Co., Jersey City, N. J. (Corrugated iron)
Stokes Rubber Co., Jos., Trenton, N. J. (Hard rubber)
United States Rubber Co., New York, N. Y. (Rubber, asbestos)
Western Felt Wks., Chicago, Ill. (Felt)
●Wilson, Inc., Grant, Chicago, Ill. (Asbestos)

GATE VALVES

See Valves, Gate

GLASS PIPE

See Pipe, Glass

GLOBE VALVES

See Valves, Globe

GOVERNORS, PUMP

Atlas Valve Co., Inc., Newark, N. J.
Bailey Meter Co., Cleveland, O.
Boylston Steam Specialty Co., Chicago, Ill.
Burrows Mfg. Co., F. A., York, Pa.
●Cash Co., A. W., Decatur, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
●Dunham Co., C. A., Chicago, Ill.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Gardner-Denver Co., Quincy, Ill.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
Northern Equipment Co., Erie, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schwitzer-Cummins Co., Indianapolis, Ind.
Spence Engineering Co., Inc., Walden, N. Y.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

GRILLES

Air Control Products, Inc., Muskegon, Mich.
Aircraft Mfg. Co., Dayton, O.
American Blower Corp., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American Warming & Ventilating Co., Toledo, O.
●Auer Register Co., Cleveland, O.
Barber-Colman Co., Rockford, Ill.
Best Register Co., Milwaukee, Wis.
Campbell Heating Co., Des Moines, Ia.
Campbell Heating Co., E. K., Kansas City, Mo.
Cross Engineering Co., Carbondale, Pa.
Crown Iron Works, Minneapolis, Minn.
Diamond Mfg. Co., Wyoming, Pa.
Erdle Perforating Co., Rochester, N. Y.
Gillian Mfg. Co., Ferndale, Mich.
Globe Machine & Stamping Co., Cleveland, O.
Harrington & King Perforating Co., Chicago, Ill.
●Hart & Cooley Mfg. Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
●Independent Register Co., Cleveland, O.
Knowles Mushroom Ventilator Co., New York, N. Y.
Metalace Corp., So. Boston, Mass.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Newman Brothers, Inc., Cincinnati, O.
Register & Grille Mfg. Co., Brooklyn, N. Y.

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Rock Island Register Co., Rock Island, Ill.
●Trane Co., La Crosse, Wis.
●Tuttle & Bailey, Inc., New Britain, Conn.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
United States Register Co., Battle Creek, Mich.
●Waterloo Register Co., Waterloo, Ia.
Wickwire Spencer Steel Co., New York, N. Y.

GUNS AND POTS, SMOKE AND SMUDGE, FOR TESTING AIR MOVEMENT

Hill, E. Vernon, Chicago, Ill.
Newman Co., Inc., I. C., New York, N. Y.
●Pains Fireworks Display Co., New York, N. Y.

HAND SHEARS

See Shears, Hand

HANGERS OR BRACKETS, RADIATOR

American Foundry & Furnace Co., Bloomington, Ill.
●American Radiator Co., New York, N. Y.
Carpenter & Paterson, Inc., East Boston, Mass.
Carty & Moore Engineering Co., Detroit, Mich.
Chicago Nipple Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Grabler Mfg. Co.. Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Hartmann Co., Chas., Brooklyn, N. Y.
Healy Ruff Co., St. Paul, Minn.
Inland Mfg. Co., Chicago, Ill. (Unit heater hangers)
Jennison Co., Fitchburg, Mass. (Adjustable radiator foot rest)
Logansport Radiator Equipment Co., Logansport, Ind.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Paine Co., Chicago, Ill.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Sterling Engineering Co., Milwaukee, Wis.
United States Radiator Corp., Detroit, Mich.
Western Hanger Co., San Francisco, Cal.

HANGERS AND SUPPORTS, PIPE

●American District Steam Co., North Tonawanda, N. Y.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Carpenter & Paterson, Inc., East Boston, Mass.
Chicago Expansion Bolt Co., Chicago, Ill.
Chicago Nipple Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos. Burlington, N. J.
Farley Sleeve & Hanger Co., Cleveland, O.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Lumsden & Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
Paine Co., Chicago, Ill.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ravena Iron Co., Ravena, N. Y.
Reznor Mfg. Co., Mercer, Pa.
●Ric-wiL Co., Cleveland, O. (Underground)
Rockwood Sprinkler Co., Worcester, Mass.
Roessing Mfg. Co., Pittsburgh, Pa.
Semler Co., Jeannette, Pa.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
Western Wire Products Co., St. Louis, Mo.

HARD RUBBER PIPE

See Pipe, Hard Rubber

HEADERS, WELDED

Acme Industries, Inc., Jackson, Mich.
Biggs Boiler Works Co., E. Akron, O.
Blaw-Knox Co., Blawnox, Pa.
Chicago Nipple Mfg. Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
●Crane Co., Chicago, Ill.
●Grinnell Co., Inc., Providence, R. I.
International Engineering Wks., Inc., Framingham, Mass.
Kellogg Co., M. W., The, New York, N. Y.
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden & Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Pipe Bending Co., New Haven, Conn.
National Valve & Mfg. Co., Pittsburgh, Pa.
Ohio Pipe Bending & Mach. Co., Cleveland, O.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
Pittsburgh Pipe Coil & Bending Co., Etna, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
●Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
Shaw Co., Benjamin F., Wilmington, Del.
Walworth Co., New York, N. Y.

HEADS, SPRINKLER

Cleghorn Co., Boston, Mass.
●Grinnell Co., Inc., Providence, R. I.
Hodgman Mfg. Co., Taunton, Mass.
Northern Indiana Brass Co., Elkhart, Ind.
Raisler Sprinkler Co., New York, N. Y.
Rockwood Sprinkler Co., Worcester, Mass.

HEAT EXCHANGERS

See Exchangers, Heat

HEATERS, AIR, DIRECT FIRED

●Airtherm Mfg. Co., St. Louis, Mo.
Bryant Heater Co., The, Cleveland, O.
●Carrier Corp., Syracuse, N. Y.
Dravo Corp., Pittsburgh, Pa.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Jackson & Church Co., Saginaw, Mich.
Lee Heating Systems, Youngstown, O.
Magirl Foundry & Furnace Wks., P. H., Bloomington, Ill.
Mayflower-Lewis Corp., St. Paul, Minn.
Nelson Co., Detroit, Mich.
New York Blower Co., Chicago, Ill.
Nugent Sons, Inc., Thos., New York, N. Y.
Reznor Mfg. Co., Mercer, Pa.
Reif-Rexoil, Inc., Buffalo, N. Y.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Ross Engineering Corp., J. O., New York, N. Y.
Smith, Inc., James Campbell, Cleveland, O.
Supreme Heater & Ventilating Corp., St. Louis, Mo.
Surface Combustion Corp., Toledo, O.
Trent Co., Harold E., Philadelphia, Pa.
Williams, Inc., F. C., Dearborn, Mich.

HEATERS, DUCT, ELECTRIC

General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Philadelphia, Pa.
Trent Co., Harold E., Philadelphia, Pa.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, DUCT, GAS

Bryant Heater Co., The, Cleveland, O.

HEATERS, SPACE, ELECTRIC

●Burnham Boiler Corp., Irvington, N. Y.
Cutler-Hammer, Inc., Milwaukee, Wis.
Electric Air Heater Co., Div. American Foundry Equipment Co., Mishawaka, Ind.
General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Philadelphia, Pa.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Lynn, Mass.
Westinghouse Electric & Mfg. Co., Mansfield, O.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, STRIP AND IMMERSION, ELECTRIC

Cutler-Hammer, Inc., Milwaukee, Wis.
Electro Hot Heater Co., Tacoma, Wash.
General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Philadelphia, Pa.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Lynn, Mass.
Westinghouse Electric & Mfg. Co., Mansfield, O.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, UNIT, ELECTRIC

Air Devices Corp., Meriden, Conn.
●Autovent Fan & Blower Co., Chicago, Ill.
Berns Specialty Co., Chicago, Ill.
Electric Air Heater Co., Div. American Foundry Equipment Co., Mishawaka, Ind.
Electro Hot Heater Co., Tacoma, Wash.
●Grinnell Co., Inc., Providence, R. I.
Hynes Electric Heating Co., Philadelphia, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Sturtevant Co., B. F., Boston, Mass.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Lynn, Mass.
Warren Electric Appliance Co., Warren, Pa.
Westinghouse Electric & Mfg. Co., Mansfield, O.
●Wiegand Co., Edwin L., Pittsburgh, Pa.
●Young Radiator Co., Racine, Wis.

HEATERS, UNIT, GAS FIRED

American Gas Products, Div. of American Radiator Co., New York, N. Y.
Automatic Gas Steam Radiator Co., Pittsburgh, Pa.
Bryant Heater Co., The, Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
●Carrier Corp., Syracuse, N. Y.
Continental Stove Corp., Ironton, O.
General Gas Light Co., Kalamazoo, Mich.
Lee Heating Systems, Youngstown, O.
Mayflower-Lewis Corp., St. Paul, Minn.
McCormick & Co., J. H., Williamsport, Pa.
McCord Radiator & Mfg. Co., Detroit, Mich.
Mueller Furnace Co., L. J., Milwaukee, Wis.

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Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Reznor Mfg. Co., Mercer, Pa.
Ross Engineering Corp., J. O., New York, N. Y.
Schoedinger, F. O., Columbus, O.
Surface Combustion Corp., Toledo, O.
●Trane Co., La Crosse, Wis.
United States Radiator Corp., Detroit, Mich.

HEATERS, UNIT, STEAM AND HOT WATER

Air Devices Corp., Meriden, Conn.
●Airtherm Mfg. Co., St. Louis, Mo.
American Blower Corp., Detroit, Mich.
●Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Beacon-Morris Corp., Boston, Mass.
Berns Specialty Co., Chicago, Ill.
Bishop & Babcock Mfg. Co., Cleveland, O.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
●Burnham Boiler Corp., Irvington, N. Y.
Campbell Heating Co., E. K, Kansas City, Mo.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Davidson Hy Duty Roof Fan Co., Newton, Mass.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Dunham Co., C. A., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Fedders Mfg. Co., Buffalo, N. Y.
●Grinnell Co., Inc., Providence, R. I.
Hartzell Propeller Fan Co, Piqua, O.
Hastings Air Conditioning Co., Hastings, Neb.
Ilg Electric Ventilating Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
Kisco Co., Inc., St. Louis, Mo.
Manufacturers Fin Coil Co., Chicago, Ill.
Mayflower-Lewis Corp., St. Paul, Minn.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Murray Iron Wks. Co., Burlington, Ia.
National Radiator Corp., Johnstown, Pa.
Nelson Corp., Herman, Moline, Ill.
●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
New York Blower Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Richmond Engineering Co., Richmond, Va.
Rome-Turney Radiator Co., Rome, N. Y.
●St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.
Thermal Units Mfg Co., Div. of Air Devices Corp., Meriden, Conn.
●Trane Co., La Crosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
●Unit Heater & Cooler Co., Wausau, Wis.
United States Radiator Corp., Detroit, Mich.
●Webster & Co., Warren, Camden, N. J.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.
●Young Radiator Co, Racine, Wis.

HEATERS, WATER, CAST IRON, COAL FIRED

American Radiator Co., New York, N. Y.
●Burnham Boiler Corp., Irvington, N. Y.
Central Radiator Co., New York, N. Y.
Cleghorn Co., Boston, Mass.
●Crane Co., Chicago, Ill.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Glore Sales Corp., Evins F., New York, N. Y.
Hart & Crouse Corp., Utica, N. Y.
International Heater Co., Utica, N. Y.
Mueller Furnace Co., L. J., Milwaukee, Wis.
National Pipe Bending Co., New Haven, Conn.
National Radiator Corp., Johnstown, Pa.
Peerless Heater Co., Boyertown, Pa.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Inc., Frank, Terre Haute, Ind.
Richardson & Boynton Co., New York, N. Y.
Smith Co., H. B., Westfield, Mass.
Spencer Heater Div., Lycoming Mfg. Co., Willamsport, Pa.
Thatcher Furnace Co., Newark, N. J.
Weil-McLain Co., Chicago, Ill.

HEATERS, WATER, GAS FIRED

American Bosch Corp., Springfield, Mass.
American Gas Products, Div. of American Radiator Co., New York, N. Y.
Bryant Heater Co., The, Cleveland, O.
Colonial Alloys Co., Specialties Div., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Dahlquist Mfg. Co., Inc., Boston, Mass.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Handley Brown Heater Co., Jackson, Mich.
International Engineering Wks., Inc., Framingham, Mass.
Johnson Co., S. T., Oakland, Cal.
●Kewanee Boiler Corp., Kewanee, Ill.
Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
Mueller Furnace Co., L. J., Milwaukee, Wis.
National Radiator Corp., Johnstown, Pa.
Norge Heating & Conditioning Div., Borg-Warner Corp., Detroit, Mich.
Pittsburgh Water Heater Co., Pittsburgh, Pa.
Richardson & Boynton Co., New York, N. Y.
Richmond Radiator Co., Uniontown, Pa.
Rotary Mfg. Co., Los Angeles, Cal.
Ruud Mfg. Co., Pittsburgh, Pa.
Schoedinger, F. O., Columbus, O.
Surface Combustion Corp., Toledo, O.
United States Radiator Corp., Detroit, Mich.

HEATERS, WATER, INDIRECT

Adams Engineering Co., Chicago, Ill.
Akwa Heaters, Inc., New York, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Automatic Stoker Corp., Milwaukee, Wis.
●Bell & Gossett Co., Chicago, Ill.
Bryan Steam Corp., Peru, Ind.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Davis Engineering Corp., Elizabeth, N. J.
d'Este Co., Julian, Charlestown, Mass.
Excelso Products Corp., Buffalo, N. Y.
Ferguson & Lange Foundry Co., Chicago, Ill.
General Fittings Co., Providence, R. I.
Koven & Bro., L. O., Jersey City, N. J.
Little Mfg. Co., M. S., Hartford, Conn.
Marion Machine Foundry & Supply Co., Marion, Ind.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Richmond Engineering Co., Richmond, Va.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Stevens-Root Co., Chicago, Ill.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
United States Radiator Corp., Detroit, Mich.
Watts Regulator Co., Lawrence, Mass.

HEATERS, WATER, OIL FIRED

American Radiator Co., New York, N. Y.
●Carrier Corp., Syracuse, N. Y.
Colonial Alloys Co., Specialties Div., Philadelphia, Pa.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Electrol, Inc., Clifton, N. J.
Gilbert & Barker Mfg. Co., Springfield, Mass.
International Engineering Wks., Inc., Framingham, Mass.
Johnson, S. T., Oakland, Cal.
●Kewanee Boiler Corp., Kewanee, Ill.
Kleen-Heet, Inc., Chicago, Ill.
Littleford Bros., Cincinnati, O.
Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
Mueller Furnace Co., L. J., Milwaukee, Wis.
National Radiator Corp., Johnstown, Pa.
Norge Heating & Conditioning Div., Borg-Warner Corp., Detroit, Mich.
Nu-Way Corp., Rock Island, Ill.
Ray Oil Burner Co., San Francisco, Cal.
Reif-Rexoil, Inc., Buffalo, N. Y.
Scott-Newcomb, Inc., St. Louis, Mo.
United States Radiator Corp., Detroit, Mich.
Wayne Oil Burner Corp., Fort Wayne, Ind.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
Wood Industries, Inc., Gar, Detroit, Mich.
York Oil Burner Co., Inc., York, Pa.

HEATERS, WATER, STEAM, INSTANTANEOUS

Akwa Heaters, Inc., New York, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
●Bell & Gossett Co., Chicago, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Davis Engineering Corp., Elizabeth, N. J.
Eclipse Fuel Engineering Co., Rockford, Ill.
General Fittings Co., Providence, R. I.
Gerstein & Cooper Co., South Boston, Mass.
Graham Mfg. Co., Buffalo, N. Y.
Griscom-Russell Co., New York, N. Y.
Hasco Valve & Machine Co., Milwaukee, Wis.
Howard Iron Wks. & Alberger Heater Co., Buffalo, N. Y.
Johnson Corp., Three Rivers, Mich.
Kisco Co., Inc., St. Louis, Mo.
Marion Machine Foundry & Supply Co., Marion, Ind.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Quaker City Iron Works, Philadelphia, Pa.
Richmond Engineering Co., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sims Co., Erie, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Swartwout Co., Cleveland, O.
Taco Heaters, Inc., New York, N. Y.
Watts Regulator Co., Lawrence, Mass.
Whitlock Coil Pipe Co., Hartford, Conn.

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HEATERS, WATER, STEAM, STORAGE

Akwa Heaters, Inc., New York, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
●Bell & Gossett Co., Chicago, Ill.
Bigelow Co., New Haven, Conn.
Biggs Boiler Works Co., E., Akron, O.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Bryant Heater Co., The, Cleveland, O.
●Burnham Boiler Corp., Irvington, N. Y.
●Crane Co., Chicago, Ill.
Dahlquist Mfg. Co., Inc., Boston, Mass.
Davis Engineering Co., Elizabeth, N. J.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Frank Engineering Co., New York, N. Y.
General Fittings Co., Providence, R. I.
Gerstein & Cooper Co., South Boston, Mass.
Griscom-Russell Co., New York, N. Y.
Hotstream Heater Co., Cleveland, O.
Howard Iron Wks. & Alberger Heater Co., Buffalo, N. Y.
Hynes Electric Heating Co., Philadelphia, Pa.
International Engineering Wks., Inc., Framingham, Mass.
Johnson Corp., Three Rivers, Mich.
●Kewanee Boiler Corp., Kewanee, Ill.
Koven & Bro., L. O., Jersey City, N. J.
Manitowoc Boiler Wks., Manitowoc, Wis.
Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
Mueller Furnace Co., L. J., Milwaukee, Wis.
National Pipe Bending Co., New Haven, Conn.
National Radiator Corp., Johnstown, Pa.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Quaker City Iron Works, Philadelphia, Pa.
Richmond Engineering Co., Richmond, Va.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Rockwood Sprinkler Co., Worcester, Mass.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Rotary Mfg. Co., Los Angeles, Cal.
Sims Co, Erie, Pa.
Taco Heaters, Inc., New York, N. Y.
Vogt Machine Co., Henry, Louisville, Ky.
Warren Electric Appliance Co., Warren, Pa. (Electric)
Watts Regulator Co., Lawrence, Mass.
Whitehead Metal Products Co. of New York, Inc., New York, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, WATER, STEEL, COAL FIRED

Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Fitzgibbons Boiler Co., New York, N. Y.
International Engineering Wks., Inc., Framingham, Mass.
Johnson Bros., Inc., Ferrysburg, Mich.
●Kewanee Boiler Corp., Kewanee, Ill.
Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
National Radiator Corp., Johnstown, Pa.
Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.

HEATING BOILERS

See Boilers, Heating

HEATING COILS

See Surface, Heating

HEATING SURFACE

See Surface, Heating

HOSE, METAL, FOR ELIMINATING COMPRESSOR VIBRATION

American Metal Hose Branch, American Brass Co., Waterbury, Conn.
Atlantic Metal Hose Co., Inc., New York, N. Y.
●Chicago Metal Hose Corp., Maywood, Ill.
Eclipse Aviation Corp., Div. of Bendix Aviation Corp., Bendix, N. J.
Seamlex Co., Long Island City, N. Y.
Titeflex Metal Hose Co., Newark, N. J.
United Metal Hose Co., Inc., Long Island City, N. Y.

HOT WATER HEATING SYSTEMS

See Systems, Heating, Hot Water

HOT WATER PRESSURE REGULATORS

See Regulators, Pressure, Hot Water Heating Systems

HUMIDIFIERS, CENTRAL PLANT

Air Conditioning Supply Co., Cleveland, O.
●Armstrong Machine Wks., Three Rivers, Mich.
●Barber-Colman Co., Rockford, Ill.
●Carrier Corp., Syracuse, N. Y.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
●Johnson Service Co., Milwaukee, Wis.
Kleenaire Corp., Stevens Point, Wis.
Lohman, Inc., Wm. J., New York, N. Y.
McCormick & Co., J. H., Williamsport, Pa.
Mellish & Murray Co., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Parks-Cramer Co., Fitchburg, Mass.
●Powers Regulator Co., Chicago, Ill.
Research Corp., New York, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
Southworth Machine Co., Portland, Me.
Steamaire Co., Cincinnati, O.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Sturtevant Co, B. F., Hyde Park, Boston, Mass
●Trane Co., La Crosse, Wis.

HUMIDIFIERS, DIRECT, SPRAY HEAD

American Moistening Co., Providence, R. I.
Ames Co., W. R., San Francisco, Cal.
Anetsberger Bros., Chicago, Ill.
Bahnson Co., Winston-Salem, N. C.
Betz Air Conditioning Corp., Kansas City, Mo.
Binks Mfg. Co., Chicago, Ill.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
Chelsea Fan & Blower Co., New York, N. Y.
International Moistening Co., Providence, R. I.
Lohman, Inc., Wm. J., New York, N. Y.
Manufacturers Machine Co., North Andover, Mass.
Marley Co., Kansas City, Mo.
Mayflower-Lewis Corp., St. Paul, Minn.
Mellish & Murray Co., Chicago, Ill.
Montag Stove & Furnace Wks., Portland, Ore.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Murray Mfg. Co., D. J., Wausau, Wis.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Parks-Cramer Co., Fitchburg, Mass.
Pfening Co., Fred D., Columbus, O.
Rega Mfg. Co., Rochester, N. Y.
Rhode Island Humidifier & Ventilating Co., Boston, Mass.
Ross Sprinkler Co., Pasadena, Cal.
Schwitzer-Cummins Co., Indianapolis, Ind.
●Somers, Inc., H. J., Detroit, Mich.
Southworth Machine Co., Portland, Me.
Spray Engineering Co., Somerville, Mass.
●Spraying Systems Co., Chicago, Ill.
Steamaire Co., Cincinnati, O.
Supreme Electric Products Corp., Rochester, N. Y.
Thermal Units Mfg. Co., Div. of Air Devices Corp., Meriden, Conn.

HUMIDIFIERS, UNIT, ROOM TYPE (Without Heating)

American Moistening Co., Providence, R. I.
Bahnson Co., Winston-Salem, N. C.
Betz Air Conditioning Corp., Kansas City, Mo.
Coolmaster Corp., Chicago, Ill.
Corozone Air Conditioning Corp., Cleveland, O.
Cugley Incubator Co., Elkhart, Ind.
Hugo Mfg. Co., Duluth, Minn.
Industrial Dryer Corp., Stamford, Conn.
International Moistening Co., Providence, R. I.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Lion Mfg. Corp., Chicago, Ill.
Lowell Air Conditioning Corp., Philadelphia, Pa.
Mayflower-Lewis Corp., St. Paul, Minn.
Parks-Cramer Co., Fitchburg, Mass.
Pfening Co., Fred D., Columbus, O.
Sheer Co., H. M., Quincy, Ill.
●Somers, Inc., H. J., Detroit, Mich.
Southworth Machine Co, Portland, Me.
Standard Engineering Wks., Pawtucket, R. I.
Steamaire Co., Cincinnati, O.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Vigor-Aire Corp., Philadelphia, Pa.

HUMIDISTATS

American Moistening Co., Providence, R. I.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Automatic Temperature Control, Inc., New York, N. Y.
Bahnson Co., Winston-Salem, N. C.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
●Detroit Lubricator Co., Detroit, Mich.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co, Philadelphia, Pa.
●Johnson Service Co., Milwaukee, Wis.
Johnson Tool Co., Inc., East Providence, R. I.
Leeds & Northrup Co., Philadelphia, Pa.
Mayflower-Lewis Corp., St. Paul, Minn.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Parks-Cramer Co., Fitchburg, Mass.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
●Somers, Inc., H. J., Detroit, Mich.
Spencer Thermostat Co., Attleboro, Mass.
Standard Engineering Wks., Pawtucket, R. I.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

HUMIDITY RECORDERS

See Recorders, Humidity

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HYDRAULIC PUMPS
See Pumps, Hydraulic

HYDRAULIC SPEED CHANGERS
See Changers, Speed, Hydraulic Coupling

HYGROMETERS
American Moistening Co., Providence, R. I.
Atlas Valve Co., Inc., Newark, N. J.
Bahnson Co., Winston-Salem, N. C.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Fee and Stemwedel, Inc., Chicago, Ill.
Foxboro Co., Foxboro. Mass.
Friez & Sons, Julien P., Baltimore, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hill, E. Vernon, Chicago, Ill.
International Moistening Co., Providence, R. I.
●Johnson Service Co., Milwaukee, Wis.
Johnson Tool Co., East Providence, R. I.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Moeller Instrument Co., Richmond Hill, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Palmer Co., Cincinnati (Norwood), O.
Scientific Instrument Co., Detroit, Mich.
Standard Engineering Wks., Pawtucket, R. I.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

HYGROSTATS
See Humidistats

IMMERSION THERMOSTATS
See Thermostats, Immersion

INDICATING THERMOMETERS
See Thermometers, Indicating

INDICATOR-CONTROLLERS, PRESSURE
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Foxboro Co., Foxboro, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

INDICATOR-CONTROLLERS, RELATIVE HUMIDITY
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

INDICATOR-CONTROLLERS, TEMPERATURE
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Wheelco Instruments Co., Chicago, Ill.

INDICATORS, CARBON DIOXIDE
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Engelhard, Inc., Chas., Newark, N. J.
Friez & Sons, Julien P., Baltimore, Md.
Hays Corp., Michigan City, Ind.
Leeds & Northrup Co., Philadelphia, Pa.
Service to Industry, West Hartford, Conn.

INDICATORS, SOUND LEVEL
General Electric Co., Schenectady, N. Y.
Industrial Apparatus Co., Chicago, Ill.
Johns-Manville, New York, N. Y.

INDIRECT HEATING SURFACE
See Surface, Heating

INDIRECT WATER HEATERS
See Heaters, Water, Indirct

INDUSTRIAL AIR CONDITIONERS
See Units, Air Conditioning, Industrial Processing

INSTANTANEOUS WATER HEATERS
See Heaters, Water, Steam, Instantaneous

INSULATION, BOILER AND TANK
Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Alfol Insulation Co., Inc., New York, N. Y. (Aluminum foil)
Aluminum Aircell Insulation Co., Detroit, Mich.
●Armstrong Cork Co., Lancaster, Pa.
Carey Co., Philip, Lockland, Cincinnati, O.
●Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Cork)
Eagle-Picher Lead Co., Cincinnati, O.
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Magnesia)
General Insulating & Mfg. Co., St. Louis, Mo.
International Vermiculite Co., Springfield, Ill.
Jamar Co., Walker, Duluth, Minn.
Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y. (Asbestos)
Keasbey & Mattison Co., Ambler, Pa.
Mineral Felt Co., Toledo, O.
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos and magnesia)
Owens-Corning Fiberglas Corp., Toledo, O. (Blanket)
Refractory & Insulation Corp., New York, N. Y. (Blanket, block, cement)
Ruberoid Co., New York, N. Y. (Asbestos, magnesia)
Sall Mountain Co., Chicago, Ill.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler, Inc., Elizabeth, N. J.
Standard Asbestos Mfg. Co., Chicago, Ill.
Standard Lime and Stone Co., Baltimore, Md. (Rock wool)
Therminsul Corp., Kalamazoo, Mich. (Felted block)
United Cork Co., Kearney, N. J. (Cork)
●Wilson, Inc., Grant, Chicago, Ill.
Zonolite Co., The, Detroit, Mich. (Plastic)

INSULATION, BUILDING
Acme Asbestos Covering & Flooring Co., Chicago, Ill. (Rock wool)
Air-O-Cel Industries, Inc., Detroit, Mich.
Alfol Insulation Co., New York, N. Y. (Aluminum foil)
Alton Mineral Wool Insulation Co., Alton, Ill.
American Flange & Mfg. Co., Inc., New York, N. Y. (Metal sheets)
●American Hair & Felt Co., Chicago, Ill. (Hair felt)
●Armstrong Cork Co., Lancaster, Pa. (Corkboard, fibreboard)
Bache & Co., Semon, New York, N. Y. (Glass wool)
Barber Co., Philadelphia, Pa.
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Butterworth, Jr., B. T., New Canaan, Conn. (Cork)
Cabot, Inc., Samuel, Boston, Mass. (Flexible)
Carey Co., Philip, Lockland, Cincinnati, O. (Rock wool)
Celotex Corp., The, Chicago, Ill.
Chamberlin Metal Weather Strip Co., Detroit, Mich. (Rock wool)
Certain-teed Products Corp., New York, N. Y. (Board; reflective)
●Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Corkboard)
Cornell Wood Products Co., Chicago, Ill.
Doheny Co., John J., Belmont, Mass. (Blanket)
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool)
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Cork, wool, felt)
Fir-Tex Insulating Board Co., St. Helens, Ore. (Wood fibreboard)
General Insulating & Mfg. Co., St. Louis, Mo. (Loose fill-Blanket-Bat)
General Insulating Products Co., Brooklyn, N. Y. (Rock wool)
Hinde & Dauch Paper Co., Sandusky, O.
Insulite Co., Minneapolis, Minn. (Wood fibre)
International Vermiculite Co., Springfield, Ill. (Loose fill)
Johns-Manville, New York, N. Y. (Rock wool and wood fibreboard)
Keasbey Co., Robert A., New York, N. Y. (Rock wool)
Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
Masonite Corp., Chicago, Ill. (Fibre board)
Mineral Felt Co., Toledo, O.
Mineral Insulation Co., Chicago Ridge, Ill. (Rock wool)
Mitchell & Smith, Inc., Detroit, Mich. (Cork)
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
National Gypsum Co., Buffalo, N. Y .
Nelson Mfg. Co., B. F., Minneapolis, Minn.
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Rock wool, vermiculite, asbestos)
●Pacific Lumber Co., The, San Francisco, Cal.
Plastergon Wall Board Co., Buffalo, N. Y. (Rigid board)
Refractory & Insulation Corp., New York, N. Y. (Rock, slag wool)
Rock Products Co., Nashville, Tenn. (Rock wool)
Rock Wool Products Co., Wabash, Ind. (Loose fill)
Ruberoid Co., New York, N. Y. (Mineral wool and aluminum foil)
Russell Insulation Co., F. C., Cleveland, O.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Specialty Converters, Inc., Chicago, Ill. (Reflective insulation)
Sprayo-Flake Co., Chicago, Ill.
Standard Asbestos Mfg. Co., Chicago, Ill. (Asbestos, hairfelt)
Standard Lime & Stone Co., Baltimore, Md. (Rock wool)
Therminsul Corp., Kalamazoo, Mich. (Rock wool block)
Truscon Steel Co., Youngstown, O. (Insulation board sealed between metal sheets)
United Cork Companies, Lyndhurst, N. J. (Cork)

● Advertisement in this issue. See Index to Advertisers, page 168.

United States Gypsum Co., Chicago, Ill. (Wool and board)
United States Mineral Wool Co., Chicago, Ill. (Mineral wool)
Universal Gypsum & Lime Co., Chicago, Ill. (Loose fill)
Upson Co., Lockport, N. Y.
Wilson & Co., Chicago, Ill. (Board)
●Wilson, Inc., Grant, Chicago, Ill. (Rock wool)
Wood Conversion Co., St. Paul, Minn. (Nu-Wood board, balsam-wool blanket)
Zonolite Co., The, Detroit, Mich. (Loose fill)

INSULATION, DUCT

Acme Asbestos Covering & Flooring Co., Chicago, Ill. (Asbestos)
Air-O-Cel Industries, Inc., Detroit, Mich.
Alfol Insulation Co., New York, N. Y. (Aluminum foil)
American Flange & Mfg. Co., Inc., New York, N. Y. (Metal sheets)
●American Hair & Felt Co., Chicago, Ill. (Hair felt)
●Armstrong Cork Co., Lancaster, Pa. (Corkboard, fibreboard)
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Burgess Battery Co., Chicago, Ill.
Cabot, Inc., Samuel, Boston, Mass. (Flexible)
Carey Co., Philip, Lockland, Cincinnati, O. (Asbestos)
Cellufoam Corp., Chicago, Ill.
Celotex Corp., The, Chicago, Ill.
●Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Cork board)
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool blankets)
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Cork, magnesia, hair felt)
Felters Co., Inc., Boston, Mass. (Wool felt)
Fir-Tex Insulating Board Co., St. Helens, Ore. (Wood fibreboard)
General Insulating & Mfg. Co., St. Louis, Mo. (Block)
General Insulating Products Co., Brooklyn, N. Y. (Acoustic rock wool)
Insulite Co., Minneapolis, Minn. (Wood fibre)
International Vermiculite Co., Springfield, Ill. (Block)
Johns-Manville, New York, N. Y. (Rock cork, asbestos)
Keasbey Co., Robert A., New York, N. Y. (Asbestos and cork)
Keasbey & Mattison Co., Ambler, Pa., (Asbestos)
Masonite Corp., Chicago, Ill. (Fibre board)
Mineral Felt Co., Toledo, O.
Mineral Insulation Co., Chicago Ridge, Ill. (Rock wool)
Mitchell & Smith, Inc., Detroit, Mich. (Cork)
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
Nelson Mfg. Co., B. F., Minneapolis, Minn.
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos and wool felt)
Owens-Corning Fiberglas Corp., Toledo, O. (Blanket)
Presstite Engineering Co., St. Louis, Mo. (Adhesive)
Refractory & Insulation Corp., New York, N. Y. (Block, blanket)
Ruberoid Co., New York, N. Y. (Asbestos cellular and laminated sheets or blocks)
Russell Insulation Co., F. C., Cleveland, O.
Sall Mountain Co., Chicago, Ill. (Asbestos)
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Self-Vulcanizing Rubber Co., Inc., Chicago, Ill.
Smith & Kanzler, Inc., Elizabeth, N. J. (Asbestos air cell type)
Sprayo-Flake Co., Chicago, Ill.
Standard Asbestos Mfg. Co., Chicago, Ill. (Asbestos, hair felt)
Therminsul Corp., Kalamazoo, Mich. (Rock wool bats, loose and granulated)
United Cork Companies, Lynhurst, N. J. (Cork)
Western Felt Wks., Chicago, Ill. (Felt)
Wilson & Co., Chicago, Ill. (Flexible)
●Wilson, Inc., Grant, Chicago, Ill.
Wood Conversion Co., St. Paul, Minn. (Balsam-wool)
Zonolite Co., The, Detroit, Mich. (Plastic)

INSULATION, PIPE

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Alfol Insulation Co., Inc., New York, N. Y. (Aluminum foil)
●American District Steam Co., North Tonawanda, N. Y. (Underground)
●Armstrong Cork Co., Lancaster, Pa. (Cork)
Carey Co., Philip, Lockland, Cincinnati, O. (Asbestos, magnesia)
●Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., New York, N. Y.
●Crane Co., Chicago, Ill. (Asbestos)
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool)
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
General Insulating & Mfg. Co., St. Louis, Mo. (Moulded)
International Vermiculite Co., Springfield, Ill. (Vermiculite)
Jamar Co., Walker, Duluth, Minn.
Johns-Manville, New York, N. Y. (Asbestos, magnesia, rock cork)
Keasbey Co., Robert A., New York, N. Y. (Asbestos and cork)
Keasbey & Mattison Co., Ambler, Pa., (Asbestos, magnesia)
Miller Rubber Co., Inc., Akron, O. (Sponge rubber)
Mineral Felt Co., Toledo, O.
Mitchell & Smith, Inc., Detroit, Mich. (Cork)
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos, magnesia)
Owens-Corning Fiberglas Corp., Toledo, O. (Sectional and flexible)
●Porter & Co., Inc., H. W., Newark, N. J. (Underground)
●Ric-wiL Co., Cleveland, O. (Underground)
Ruberoid Co., New York, N. Y. (Asbestos, magnesia)
Sall Mountain Co., Chicago, Ill. (Asbestos)
Self-Vulcanizing Rubber Co., Inc., Chicago, Ill.
Smith & Kanzler, Inc., Elizabeth, N. J. (Asbestos air cell, wool felt and hair felt)
Standard Asbestos Mfg. Co., Chicago, Ill.
Standard Lime & Stone Co., Baltimore, Md. (Rockwool)
Therminsul Corp., Kalamazoo, Mich. (Rock wool)
United Cork Companies, Lyndhurst, N. J.
●Wilson, Inc., Grant, Chicago, Ill.
Wyckoff & Son Co., A., Elmira, N. Y. (Wood)

INSULATION, SOUND DEADENING, CEILING AND WALL

Air-O-Cel Industries, Inc., Detroit, Mich.
Aluminum Aircell Insulation Co., Detroit, Mich.
●American Hair & Felt Co., Chicago, Ill.
●Armstrong Cork Co., Lancaster, Pa.
Barber Co., Philadelphia, Pa.
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Burgess Battery Co., Chicago, Ill.
Cabot, Inc., Samuel, Boston, Mass. (Flexible)
Celotex Corp., The, Chicago, Ill.
Chamberlin Metal Weatherstrip Co., Detroit, Mich. (Rock wool)
Doheny Co., John J., Belmont, Mass.
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool felt)
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Rock wool, hair felt)
Felters Co., Inc., Boston, Mass.
Fir-Tex Insulating Board Co., St. Helens, Ore.
General Insulating & Mfg. Co., St. Louis, Mo.
General Insulating Products Co., Brooklyn, N. Y. (Insulwool-tile & blanket)
Insulite Co., Minneapolis, Minn.
Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa. (Sprayed)
Keldur Corp., New York, N. Y.
Masonite Corp., Chicago, Ill. (Fibreboard)
Mineral Felt Co., Toledo, O.
Mitchell & Smith, Inc., Detroit, Mich. (Cork)
Norristown Magnesia & Asbestos Co., Norristown, Pa.
Owens-Corning Fiberglas Corp., Toledo, O. (Blankets and bats)
●Pacific Lumber Co., The, San Francisco, Cal.
Plastergon Wall Board Co., Buffalo, N. Y. (Rigid board)
Rock Products Co., Nashville, Tenn.
Ruberoid Co., New York, N. Y.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Therminsul Corp., Kalamazoo, Mich. (Rock wool)
Upson Co., Lockport, N. Y.
Western Felt Wks., Chicago, Ill. (Felt)
Wood Conversion Co., St. Paul, Minn. (Nu-Wood, Balsam-wool)
Zonolite Co., The, Detroit, Mich. (Loose fill)

INSULATION, SOUND DEADENING, DUCT

Air-O-Cel Industries, Inc., Detroit, Mich.
●American Hair & Felt Co., Chicago, Ill.
●Armstrong Cork Co., Lancaster, Pa.
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Burgess Battery Co., Chicago, Ill.
Cabot, Inc., Samuel, Boston, Mass. (Flexible)
Celotex Corp., The, Chicago, Ill.
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool felt)
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Rock wool, hair felt)
Felters Co., Inc., Boston, Mass.
Fir-Tex Insulating Board Co., St. Helens, Ore.
General Insulating & Mfg. Co., St. Louis, Mo.
General Insulating Products Co., Brooklyn, N. Y. (Insulwool, blanket)
Insulite Co., Minneapolis, Minn.
Inter-Coastal Paint Corp., East St. Louis, Ill.
Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.
Masonite Corp., Chicago. Ill.
Maxim Silencer Co., Hartford, Conn.
Mineral Felt Co., Toledo, O.
Mitchell & Smith, Inc., Detroit, Mich. (Cork)
Mortell Co., J. W., Chicago, Ill.
Nelson Mfg. Co., B. F., Minneapolis, Minn.
Ruberoid Co., New York, N. Y.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Therminsul Corp., Kalamazoo, Mich.
Western Felt Wks., Chicago, Ill. (Felt)
Wilson & Co., Chicago, Ill.
●Wilson, Inc., Grant, Chicago, Ill.
Wood Conversion Co., St. Paul, Minn. (Balsam-wool)
Zonolite Co., The, Detrot, Mich.

IONIZATION APPARATUS

American Hydrozone Co., Inc., New York, N. Y.
Corozone Air Conditioning Corp., Cleveland, O.
Electroaire Corp., Chicago, Ill.
Fresh'nd-Aire Co., Chicago, Ill.
Lowell Air Conditioning Corp., Philadelphia, Pa.
Montgomery Bros., San Francisco, Cal.
Norwood Engineering Co., The, Florence, Mass.
Ozo-Ray Process Corp., Chicago, Ill.
United States Ozone Co. of America, Scottdale, Pa.

● *Advertisement in this issue. See Index to Advertisers, page 168.*

IRON BODY VALVES
See Valves, Gate and Valves, Globe

JOINTS, PIPE, EXPANSION, FLEXIBLE
Badger Fire Extinguisher Co., Boston, Mass.
Badger & Sons Co., E. B., Boston, Mass. (Corrugated copper, stainless steel)
Barco Mfg. Co., Chicago, Ill.
Belfield Co., H., Philadelphia, Pa.
Central Station Steam Co., Detroit, Mich.
●Crane Co., Chicago, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Dresser Mfg. Co., S. R., Bradford, Pa.
Foster Wheeler Corp., New York, N. Y.
●Fulton Sylphon Co., Knoxville, Tenn.
Kopperman & Sons, Joseph, Philadelphia, Pa.
Lapp Insulator Co., Inc., LeRoy, N. Y. (Porcelain)
Northern Indiana Brass Co., Elkhart, Ind.
Semet-Solvay Engineering Corp., New York, N. Y.
Taylor Forge & Pipe Wks., Chicago, Ill.
United States Rubber Co., New York, N. Y.
Victaulic Co. of America, New York, N. Y.
Walworth Co., New York, N. Y.

JOINTS, PIPE, EXPANSION, SLIP
●American District Steam Co., North Tonawanda, N. Y.
Central Station Steam Co., Detroit, Mich.
Duriron Co., Inc., Dayton, O. (Acid resisting)
●Fulton Sylphon Co., Knoxville, Tenn.
Howard Iron Works & Alberger Heater Co., Buffalo, N. Y.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Taylor Forge & Pipe Wks., Chicago, Ill.
Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
●Yarnall-Waring Co., Philadelphia, Pa.

JOINTS, RING
Kopperman & Sons, Joseph, Philadelphia, Pa.
Walworth Co., New York, N. Y.

KATA THERMOMETERS
See Thermometers, Kata

LACQUERS
See Enamels and Lacquers

LAMPS, STERILIZING, FOR DUCT INSTALLATION
Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

LEAD PIPE
See Pipe, Lead

LEAD SHEETS
See Sheets, Lead

LEAK DETECTORS
See Detectors, Leak, Refrigerant

LEATHER BELTING
See Belting, Leather

LEATHER PACKING
See Packing, Leather

LIQUID LEVEL GAGES
See Gages, Liquid Level

LIQUID LEVEL RECORDERS
See Recorders, Liquid Level

LIQUID PRESSURE REGULATORS
See Regulators, Pressure, Liquid

LOCK FORMING MACHINES
See Machines, Pittsburgh Lock Forming

LOUVERS AND SHUTTERS
Air Conditioning Products Co., Detroit, Mich.
●Airtherm Mfg. Co., St. Louis, Mo.
Allen Corp., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American Warming & Ventilating Co., Toledo, O.
Arex Co., Chicago, Ill.
●Autovent Fan & Blower Co., Chicago, Ill.
Burt Mfg. Co., Akron, O.
Champion Blower & Forge Co., Lancaster, Pa.
Chicago Metal Mfg. Co., Chicago, Ill.
Cornell Iron Wks., Inc., Long Island City, N. Y. (Rolling steel)
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Elgo Shutter & Mfg. Co., Detroit, Mich.
General Blower Co., Inc., Philadelphia, Pa.
Gillian Mfg. Co., Ferndale, Mich.
Kelvin-White Co., Boston, Mass.
King Ventilating Co., Owatonna, Minn.
Kirk & Blum Mfg. Co., Cincinnati, O.
Kisco Co., Inc., St. Louis, Mo.
Meyer Mfg. Co., Detroit, Mich.
Mountain States Equipment Co., Denver, Colo.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Robertson Co., H. H., Pittsburgh, Pa.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Utility Fan Corp., Los Angeles, Cal.
●Waterloo Register Co., Waterloo, Ia.

LUBRICATING OIL
See Oil, Lubricating

MACHINES AND FILM, X-RAY
Eastman Kodak Co., Rochester, N. Y.
Kelly-Koet, Covington, Ky.
Westinghouse X-Ray Div., Long Island City, N. Y.

MACHINES, PIPE CUTTING AND THREADING, PORTABLE
Air Reduction Sales Co., New York, N. Y. (Cutting and beveling)
Beaver Pipe Tools, Inc., Warren, O.
Curtis & Curtis Co., Bridgeport, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
●Linde Air Products Co., The, New York, N. Y. (Cutting and beveling)
National Machine Works, Chicago, Ill.
Nye Tool & Machine Wks., The, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Peerless Mach. Co., Racine, Wis.
Ridge Tool Co., Elyria, O. (Hand)
Toledo Pipe Threading Machine Co., Toledo, O.

MACHINES, PIPE CUTTING AND THREADING, STATIONARY
Beaver Pipe Tools, Inc., Warren, O.
Bignall & Keeler Machine Wks., Edwardsville, Ill.
Bullard Co., The, Bridgeport, Conn. (Vertical, threading & boring)
Curtis & Curtis Co., Bridgeport, Conn.
Jarecki Mfg. Co., Erie, Pa.
Landis Machine Co., Inc., Waynesboro, Pa.
Merrell Mfg. Co., Toledo, O.
National Machine Works, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Saunders Sons, Inc., D., Yonkers, N. Y.
Toledo Pipe Threading Machine Co., Toledo, O.

MACHINES, PITTSBURGH LOCK FORMING
Peck, Stow & Wilcox Co., Southington, Conn.
Verson Allsteel Press Co., Chicago, Ill.
Ward Machinery Co., Chicago, Ill.

MACHINES, REFRIGERATION, ABSORPTION
Philadelphia & Reading Coal & Iron Co., Philadelphia, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
●York Ice Machinery Corp., York, Pa.

MALLEABLE UNIONS
See Unions, Malleable

MANIFOLDS, REFRIGERATION
●Baker Ice Machine Co., Inc., Omaha, Neb.
Mueller Brass Co., Port Huron, Mich.
Superior Valve and Fittings Co., Pittsburgh, Pa.
●York Ice Machinery Corp., York, Pa.

MANOMETERS
American Blower Corp., Detroit, Mich.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Friez & Sons, Julien P., Baltimore, Md.
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Norwood Engineering Co., The, Florence, Mass.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

MECHANICAL DRIVE TURBINES
See Turbines, Mechanical Drive

MECHANICAL SPEED CHANGERS
See Changers, Speed, Mechanical

MECHANICAL TRAPS
See Traps, Steam, Mechanical

MERCURY SWITCHES
See Switches, Mercury

METAL HOSE
See Hose, Metal, for Eliminating Compressor Vibration

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METALLIC PACKING

See Packing, Metallic

METERS, AIR VELOCITY, DIRECT READING

Detroit Air Meter Co., Detroit, Mich.
Friez & Sons, Julien P., Baltimore, Md.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Taylor Instrument Companies, Rochester, N. Y.

METERS, CONDENSATION

●American District Steam Co., North Tonawanda, N. Y.
Buffalo Meter Co., Buffalo, N. Y.
Central Station Steam Co., Detroit, Mich.
Morehead Mfg. Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Worthington-Gamon Meter Co., Harrison, N. J.

METERS, FLOW, PROCESS LIQUID

Bailey Meter Co., Cleveland, O.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Buffalo Meter Co., Buffalo, N. Y.
Builders Iron Foundry, Providence, R. I.
Foxboro Co., Foxboro, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Republic Flow Meters Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Spray Engineering Co., Somerville, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

METERS, FLOW, STEAM

●American District Steam Co., North Tonawanda, N. Y.
American Meter Co., New York, N. Y.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
●Cochrane Corp., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

METERS, WATER

Bailey Meter Co., Cleveland, O.
Buffalo Meter Co., Buffalo, N. Y.
Builders Iron Foundry, Providence, R. I.
Foxboro Co., Foxboro, Mass.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
National Meter Co., Brooklyn, N. Y.
Neptune Meter Co., New York, N. Y.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Republic Flow Meters Co., Chicago, Ill.
Union Water Meter Co., Worcester, Mass.
Worthington-Gamon Meter Co., Harrison, N. J.
●Worthington Pump & Machinery Corp., Harrison, N. J.

MIXING DAMPERS

See Dampers, Duct

MIXING VALVES

See Valves, Mixing, Steam and Water

MODULATING VALVES

See Valves, Radiator, Steam and Hot Water

MOTOR BASES

See Bases and Pads, Vibration Isolating

MOTOR CONTROLLERS

See Controllers and Starters, Motor

MOTOR-OPERATED VALVES

See Valves, Motor-operated

MOTOR STARTERS

See Controllers and Starters, Motor

MOTORS, ELECTRIC, FRACTIONAL HP

Au-Temp-Co Corp., New York, N. Y.
Baldor Electric Co., St. Louis, Mo.
Barber-Colman Co., Rockford, Ill.
Black & Decker Mfg. Co., Towson, Md.
Bodine Electric Co., Chicago, Ill.
Brown-Brockmeyer Co., Dayton, O.
Burke Electric Co., Erie, Pa.
Canatsey Electric Mfg. Co., Kansas City, Mo.
●Century Electric Co., St. Louis, Mo.
●Delco Products Corp., Dayton, O.
Diehl Mfg. Co., Elizabeth, N. J.
Emerson Electric Mfg. Co., St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Hansen Mfg. Co., Inc., Princeton, Ind.
●Holtzer-Cabot Electric Co., Boston, Mass.
Howell Electric Motors Co., Howell, Mich.
Janette Mfg. Co., Chicago, Ill.
Leland Electric Co., Dayton, O.
Marathon Electric Mfg. Corp., Wausau, Wis.
Master Electric Co., Dayton, O.
Ohio Electric Mfg. Co., Cleveland, O.
Peerless Electric Co., Warren, O.
Robbins & Myers, Inc., Springfield, O.
Speedway Mfg. Co., Chicago (Cicero), Ill.
Sterling Electric Motors, Inc., Los Angeles, Cal.
Sturtevant Co., B. F., Boston, Mass.
U. S. Electrical Motors, Inc., Los Angeles, Cal.
●Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS, ELECTRIC, 1 HP AND OVER

Allis Co., Louis, Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Baldor Electric Co., St. Louis, Mo.
Brown-Brockmeyer Co., Dayton, O.
Burke Electric Co., Erie, Pa.
Canatsey Electric Mfg. Co., Kansas City, Mo.
●Century Electric Co., St. Louis, Mo.
Continental Electric Co., Inc., Newark, N. J.
Crocker-Wheeler Elec. Mfg. Co., Ampere, N. J.
●Delco Products Corp., Dayton, O.
Diehl Mfg. Co., Elizabeth, N. J.
Electric Machinery Mfg. Co., Minneapolis, Minn.
Elliott Co., Jeanette, Pa.
Emerson Electric Mfg. Co., St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee, Wis.
●Holtzer-Cabot Electric Co., Boston, Mass. (2 & less)
Howell Electric Motors Co., Howell, Mich.
Ideal Electric & Mfg. Co., Mansfield, O.
Imperial Electric Co., Akron, O.
Janette Mfg. Co., Chicago, Ill.
Leland Electric Co., Dayton, O.
Lincoln Electric Co., Cleveland, O.
Marathon Electric Mfg. Corp., Wausau, Wis.
Marble-Card Electric Co., Gladstone, Mich.
Master Electric Co., Dayton, O.
Peerless Electric Co., Warren, O.
Philadelphia Gear Co., Philadelphia, Pa. (Geared)
Reliance Electric & Engineering Co., Cleveland, O.
Robbins & Myers, Inc., Springfield, O.
Star Electric Motor Co., Bloomfield, N. J.
Sterling Electric Motors, Inc., Los Angeles, Cal.
Sturtevant Co., B. F., Boston, Mass.
U. S. Electrical Motors, Inc., Los Angeles, Cal.
●Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Zobell Electric Motor Corp., Garwood, N. J.

MUSHROOM VENTILATORS

See Ventilators, Mushroom

NEEDLE VALVES

See Valves, Needle

NIPPLES, PIPE, BRASS AND COPPER

Acheson Mfg. Co., Rankin, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Nipple Mfg. Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Mfg. Co., New York, N. Y.
Mueller Brass Co., Port Huron, Mich.
Parker Appliance Co., Cleveland, O.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Shaw-Kendall Engineering Co., Toledo, O.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
Weatherhead Co., Cleveland, O.

NIPPLES, PIPE, IRON AND STEEL

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Byers Co., A. M., Pittsburgh, Pa. (Wrought iron)
Chicago Nipple Mfg. Co., Chicago, Ill.
Cohoes Rolling Mill Co., Cohoes, N. Y.
Colonial Alloys Co., Specialties Div., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Dresser Mfg. Co., S. R., Bradford, Pa.
Flagg & Co. Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Limbert & Co., Geo. B., Chicago, Ill.

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Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Shaw-Kendall Engineering Co., Toledo, O.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

NOISE ELIMINATORS

See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration; Insulation, Sound Deadening

NOZZLES, SPRAY

Balloffet Dies and Nozzle Co., Inc., Guttenberg, N. J.
Bayley Blower Co., Milwaukee, Wis.
Binks Mfg. Co., Chicago, Ill.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Chain Belt Co., Milwaukee, Wis.
●Clarage Fan Co., Kalamazoo, Mich.
Cooling Tower Co., Inc., The, Div. of The Fluor Corp., Ltd., New York, N. Y.
●Detroit Lubricator Co., Detroit, Mich.
DeVilbiss Co., The, Toledo, O.
Dustlix Corp., Milwaukee, Wis.
Fluor Corp., Ltd., The, Los Angeles, Cal.
Goodrich Co., B. F., Akron, O.
Howell Mfg. Co., Kansas City, Mo.
International Moistening Co., Providence, R. I.
Link-Belt Co., Chicago, Ill.
Marley Co., Kansas City, Mo.
Martocello & Co., Jos. A., Philadelphia, Pa.
●Monarch Mfg. Wks., Inc., Philadelphia, Pa.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
Northern Indiana Brass Co., Elkhart, Ind.
Parks-Cramer Co., Fitchburg, Mass.
Penn Cooling Tower Wks., Pittsburgh, Pa.
Rega Mfg. Co., Rochester, N. Y.
Ross Sprinkler Co., Pasadena, Cal.
Schubert-Christy Corp., Affton Station, St. Louis, Mo.
Schutte & Koerting Co., Philadelphia, Pa.
Skinner Irrigation Co., Troy, O.
Spence Engineering Co., Inc., Walden, N. Y.
Spray Engineering Co., Somerville, Mass.
●Spraying Systems Co., Chicago, Ill.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Supreme Electric Products Corp., Rochester, N. Y.
●Yarnall-Waring Co., Philadelphia, Pa.

ODOR ADSORBERS

See Filters, Air

OIL BURNERS

See Burners, Oil

OIL, LUBRICATING

Atlas Chemical Co., Marietta, O.
●Frick Co., Waynesboro, Pa.
Gulf Oil Corp., Pittsburgh, Pa.
Houghton & Co., E. F., Philadelphia, Pa.
Indian Refining Co., Indianapolis, Ind.
Marathon Oil Co., Tulsa, Okla.
Mid-Continent Petroleum Corp., Tulsa, Okla.
Sinclair Refining Co., New York, N. Y.
Standard Oil Co. of California, San Francisco, Cal.
Standard Oil Co. of Indiana, Chicago, Ill.
Standard Oil Co. of New Jersey, New York, N. Y.
Texas Co., New York, N. Y.
●York Ice Machinery Corp., York, Pa.

OIL SEPARATORS

See Separators, Steam and Oil

OPEN END WRENCHES

See Wrenches, Open End

OPERATORS, DAMPER, DUCT

American Radiator Co., New York, N. Y.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Barber-Colman Co., Rockford, Ill.
Cooper Co., Clark, Philadelphia, Pa.
●Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Baltimore, Md.
●Fulton Sylphon Co., Knoxville, Tenn.
General Controls Co., Glendale, Cal.
Gillian Mfg. Co., Ferndale, Mich.
●Johnson Service Co., Milwaukee, Wis.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

OPERATORS, VALVE

Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Barber-Colman Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bristol Co., Waterbury, Conn.
Cooper Co., Clark, Philadelphia, Pa.
●Detroit Lubricator Co., Detroit, Mich.
●Fulton Sylphon Co., Knoxville, Tenn.
General Controls Co., Glendale, Cal.
●Johnson Service Co., Milwaukee, Wis.
Mason-Neilan Regulator Co., Boston, Mass.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
R-S Products Corp., Philadelphia, Pa.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

OXY-ACETYLENE WELDING

See Welding and Cutting Apparatus, Oxy-Acetylene

OZONE APPARATUS

American Hydrozone Co., Inc., New York, N. Y.
Chelsea Fan & Blower Co., New York, N. Y.
Corozone Air Conditioning Corp., Cleveland, O.
Electroaire Corp., Chicago, Ill.
Fresh'nd-Aire Co., Chicago, Ill.
Lohman, Inc., Wm. J., New York, N. Y.
Montgomery Bros., San Francisco, Cal.
Norwood Engineering Co., The, Florence, Mass.
Ozo-Ray Process Corp., Chicago, Ill.
Sealkote Corp., Chicago, Ill.
Triox Engineering Co., St. Louis, Mo.
United States Ozone Co. of America, Scottdale, Pa.

PACKING, ASBESTOS

Acme Asbestos Coverings & Flooring Co., Chicago, Ill.
Allpax Co., Inc., Mamaroneck, N. Y.
Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., Philadelphia, Pa.
Carey Co., Philip, Lockland, Cincinnati, O.
Chicago Specialty Mfg. Co., Chicago, Ill.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y.
Durabla Mfg. Co., New York, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Garlock Packing Co., Palmyra, N. Y.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Goodrich Co., B. F., Akron, O. (Sheet)
Greene, Tweed & Co., New York, N. Y.
●Jenkins Bros., New York, N. Y.
Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Klingerit, Inc., New York, N. Y. (Sheet & rod)
Metallo Gasket Co., New Brunswick, N. J.
Sall Mountain Co., Chicago, Ill.
United States Rubber Co., New York, N. Y.
●Wilson, Inc., Grant, Chicago, Ill.

PACKING, FIBRE

Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., Philadelphia, Pa.
Darcoid Co., Inc., New York, N. Y.
Durabla Mfg. Co., New York, N. Y.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Endura Mfg. Corp., Quakertown, Pa.
Garlock Packing Co., Palmyra, N. Y.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.
Metallo Gasket Co., New Brunswick, N. J.
Paxtix, Inc., Chicago, Ill.

PACKING, LEATHER

Alexander Bros., Philadelphia, Pa.
Belmont Packing & Rubber Co., Philadelphia, Pa.
Chicago Belting Co., Chicago, Ill.
Excelsior Leather Washer Co., Rockford, Ill.
Graton & Knight Co., Worcester, Mass.
Houghton & Co., E. F., Philadelphia, Pa.
Rhoads & Sons, J. E., Wilmington, Del.
●Watson-Stillman Co., Roselle, N. J.

PACKING, METALLIC

Aeco Packing Products Co., Chicago, Ill.
Allpax Co., Inc., Mamaroneck, N. Y.
Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., Philadelphia, Pa.
Conneaut Packing Co., Conneaut, O.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y.
Felt Products Mfg. Co., Chicago, Ill.
France Packing Co., Tacony, Philadelphia, Pa.
Garlock Packing Co., Palmyra, N. Y.

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Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Hound Packing Co., Chicago, Ill.
Johns-Manville, New York, N. Y.
Klingerit, Inc., New York, N. Y. (Sheet & rod)
Rotary Seal Co., Chicago, Ill.
United States Rubber Co., New York, N. Y.

PACKING, RUBBER

Akron Metallic Gasket Co., Akron, O.
Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., Philadelphia, Pa.
Boston Woven Hose & Rubber Co., Cambridge, Mass.
Chicago Specialty Mfg. Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Garlock Packing Co., Palmyra, N. Y.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Hamilton Rubber Mfg. Co., Trenton, N. J.
●Jenkins Bros., New York, N. Y.
Johns-Manville, New York, N. Y.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan Inc., Passaic, N. J.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
United States Rubber Co., New York, N. Y.

PARTS, PRESSED AND STAMPED SHEET METAL

Berger Mfg. Div., Republic Steel Corp., Dayton, O.
Bossert Corp., Utica, N. Y.
Dayton Rogers Mfg. Co., Minneapolis, Minn.
Falstrom Co., Passaic, N. J.
Geuder, Paeschke & Frey Co., Milwaukee, Wis.
Gillian Mfg. Co., Ferndale, Mich.
Martin-Parry Corp., York, Pa.
Maysteel Products, Inc., Mayville, Wis.
Mullins Mfg. Corp., Salem, O.
Scovill Mfg. Co., Waterbury, Conn.
Utica Products, Inc., Utica, N. Y.
Youngstown Pressed Steel Co., Warren, O.

PILLOW BLOCKS

See Blocks, Pillow

PIPE, ALLOY

Aluminum Co. of America, Pittsburgh, Pa.
●American Brass Co., Waterbury, Conn.
American Radiator Co., New York, N. Y. (Cast iron)
●American Rolling Mill Co., Middletown, O. (Stainless steel)
Babcock & Wilcox Co., New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn. (Copper alloy)
Chase Brass & Copper Co., Waterbury, Conn.
Colonial Alloys Co., Specialties Div., Philadelphia, Pa.
Duraloy Co., Pittsburgh, Pa. (Stainless)
Duriron Co., Inc., Dayton, O.
Flemm Lead Co., Inc., Long Island City, N. Y. (Antimonial)
International Nickel Co., New York, N. Y. (Monel)
National Tube Co., Pittsburgh, Pa.
●Republic Steel Corp., Cleveland, O.
●Revere Copper & Brass, Inc., New York, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Spang-Chalfant, Inc., Pittsburgh, Pa.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
United States Steel Corp., Pittsburgh, Pa. (Steel)
Warren Foundry & Pipe Corp., New York, N. Y.
Wheeling Steel Corp., Wheeling, W. Va.

PIPE, ASBESTOS FIBRE AND CEMENT

Allen-Sherman-Hoff Co., Philadelphia, Pa.
Carey Co., Philip, Lockland, Cincinnati, O.
Continental Diamond Fibre Co., Newark, Del. (Fibre, bakelite)
Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Sall Mountain Co., Chicago, Ill.
●Wilson, Inc., Grant, Chicago, Ill.

PIPE BENDERS

See Benders, Pipe

PIPE, BRASS

●American Brass Co., Waterbury, Conn.
American Radiator Co., New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Hussey & Co., C. G., Pittsburgh, Pa.
Mueller Brass Co., Port Huron, Mich.
●Revere Copper & Brass, Inc., New York, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
United States Brass & Copper Co., Hyde Park, Boston, Mass.
Wolverine Tube Co., Detroit, Mich.

PIPE, CAST IRON, PRESSURE, BELL AND SPIGOT

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
●Crane Co., Chicago, Ill.
Lynchburg Foundry Co., Lynchburg, Va.
McWane Cast Iron Pipe Co., Birmingham, Ala.
U. S. Pipe & Fdry. Co., Burlington, N. J.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE, CAST IRON, PRESSURE FLANGED

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
●Crane Co., Chicago, Ill.
McWane Cast Iron Pipe Co., Birmingham, Ala.
U. S. Pipe & Fdry. Co., Burlington, N. J.
Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE, CAST IRON, THREADED

American Cast Iron Pipe Co., Birmingham, Ala.
American Radiator Co., New York, N. Y.
Clow & Sons, Jas. B., Chicago, Ill.
●Crane Co., Chicago, Ill.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill. (Steam-jacketed)
Lumsden & Van Stone Co., South Boston, Mass.
McWane Cast Iron Pipe Co., Birmingham, Ala.
Somerville Iron Wks., Somerville, N. J.
U. S. Pipe & Foundry Co., Burlington, N. J.
Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE COILS

See Coils, Pipe

PIPE, COPPER

●American Brass Co., Waterbury, Conn.
American Radiator Co., New York, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Hussey & Co., C. G., Pittsburgh, Pa.
Mueller Brass Co., Port Huron, Mich.
Phelps Dodge Copper Products Corp., British American Tube Div., New York, N. Y.
●Revere Copper & Brass, Inc., New York, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
United States Brass & Copper Co., Hyde Park, Boston, Mass.
Wolverine Tube Co., Detroit, Mich.

PIPE COUPLINGS

See Couplings, Pipe

PIPE CUTTERS

See Cutters

PIPE CUTTING MACHINES

See Machines, Pipe Cutting and Threading

PIPE EXTRACTORS

See Extractors, Pipe

PIPE FITTINGS

See Fittings, Pipe

PIPE FLANGES

See Flanges, Pipe

PIPE, GLASS

Corning Glass Wks., Corning, N. Y.

PIPE HANGERS

See Hangers and Supports, Pipe

PIPE JOINT COMPOUNDS

See Cement and Compounds, Pipe Joint

PIPE INSULATION

See Insulation, Pipe

PIPE, LEAD

Andrews Lead Co., Long Island City, N. Y.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.

PIPE, LINED

●American Brass Co., Waterbury, Conn. (Tin)
American Cast Iron Pipe Co., Birmingham, Ala. (Cement)
American Hard Rubber Co., New York, N. Y. (Rubber)
Cohoes Rolling Mill Co., Cohoes, N. Y. (Cement)
Goodrich Co., B. F., Akron, O. (Rubber-lined)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead and tin lined)
Manhattan Rubber Mfg. Co. Div. of Raybestos-Manhattan, Inc., Passaic, N. J. (Rubber)
National Lead Co., New York, N. Y. (Lead)
National Tube Co., Pittsburgh, Pa. (Cement)
Public Works Supply Co., Lynn, Mass. (Cement)
●Republic Steel Corp., Cleveland, O. (Cement lined)
Resisto Pipe & Valve Co., East Cambridge, Mass. (Lead)
United States Rubber Co., New York, N. Y. (Rubber)

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Vitreous Enameling & Stamping Co., New York, N. Y. (Enamel)
Warren Foundry & Pipe Corp., New York, N. Y. (Cement-bituminous enamel)

PIPE LINE STRAINERS

See Strainers, Pipe Line

PIPE NIPPLES

See Nipples, Pipe

PIPE REAMERS

See Reamers, Pipe

PIPE REPAIR CLAMPS

See Clamps, Pipe Repair

PIPE, SEAMLESS, STEEL

Babcock & Wilcox Co., New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Globe Steel Tubes Co., Milwaukee, Wis.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Spang Chalfant, Inc., Pittsburgh, Pa.
Timken Steel & Tube Co., Canton, O.
United States Steel Corp., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE, SPIRAL, RIVETED AND WELDED

●American Rolling Mill Co., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Naylor Pipe Co., Chicago, Ill.
Taylor Forge & Pipe Wks., Chicago, Ill.

PIPE, STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Alloy Steel Products Co., Linden, N. J. (Stainless Steel)
●American Rolling Mill Co., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Byers Co., A. M., Pittsburgh, Pa.
Central Tube Co., Pittsburgh, Pa.
Cohoes Rolling Mill Co., Cohoes, N. Y.
Fretz-Moon Tube Co., Butler, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
Mark & Co., Clayton, Chicago, Ill.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Pittsburgh Tube Co., Pittsburgh, Pa.
●Republic Steel Corp., Cleveland, O.
South Chester Tube Co., Chester, Pa.
Spang Chalfant, Inc., Pittsburgh, Pa.
United States Steel Corp., Pittsburgh, Pa.
Wheatland Tube Co., Philadelphia, Pa.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

PIPE SUPPORTS

See Hangers and Supports, Pipe

PIPE TONGS

See Tongs, Pipe

PIPE VISES

See Vises, Pipe

PIPE, WOOD

●American District Steam Co., North Tonawanda, N. Y.
Caldwell Co., W. E., Louisville, Ky.
Michigan Pipe Co., Bay City, Mich.
Wyckoff & Son Co., A., Elmira, N. Y.

PIPE WRENCHES

See Wrenches, Pipe

PIPE, WROUGHT IRON

Byers Co., A. M., Pittsburgh, Pa.
Cohoes Rolling Mill Co., Cohoes, N. Y.
South Chester Tube Co., Chester, Pa.

PIPE AND FITTINGS, HARD RUBBER

American Hard Rubber Co., New York, N. Y.
Goodrich Co., B. F., Akron, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Stokes Rubber Co., Jos., Trenton, N. J.
United States Rubber Co., New York, N. Y.

PIPE AND FITTINGS, STONEWARE

Continental Diamond Fibre Co., Newark, Del. (Molded plastic)
General Ceramics Co., New York, N. Y.
Knight, Maurice A., Akron, O. (Stoneware)
Lapp Insulator Co., Inc., Le Roy, N. Y.
U. S. Stoneware Co., New York, N. Y. (Stoneware)

PIPING, FABRICATED

See Bends, Headers, Joints, etc.

PITOT TUBES

See Tubes, Pitot

PITTSBURGH LOCK FORMING MACHINES

See Machines, Pittsburgh Lock Forming

PLATES, FLOOR AND CEILING

American Radiator Co., New York, N. Y.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Chicago Nipple Mfg. Co., Chicago, Ill.
Farley Sleeve & Hanger Co., Cleveland, O.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Jarecki Mfg. Co., Erie, Pa.
Keeney Mfg. Co., Newington, Conn.
Little Mfg. Co., M. S., Hartford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ravena Iron Co., Ravena, N. Y.
Russell Mfg. Co., John M., Naugatuck, Conn.
United States Steel Corp., Pittsburgh, Pa.

PLUG COCKS

See Valves, Plug

PLUG VALVES

See Valves, Plug

POWER SHEARS

See Shears, Power

PREHEATERS, FUEL OIL

Alco Products, Div. of American Locomotive Co., New York, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
●Bell & Gossett Co., Chicago, Ill.
Davis Engineering Corp., Elizabeth, N. J.
General Fittings Co., Providence, R. I.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Griscom-Russell Co., New York, N. Y.
Hynes Electric Heating Co., Philadelphia, Pa.
Johnson Corp., Three Rivers, Mich.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
R-S Products Corp., Philadelphia, Pa.
Richmond Engineering Co., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Taco Heaters, Inc., New York, N. Y.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Lynn, Mass.
Whitlock Coil Pipe Co., Hartford, Conn.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

PREHEATERS AND STRESS RELIEVERS, ELECTRIC, FOR PIPE WELDS

Kuhlman Electric Co., Detroit Electric Furnace Div., Bay City, Mich.
R-S Products Corp., Philadelphia, Pa.
Swoboda, Inc., H. O., New Brighton, Pa.
Trent Co., Harold E., Philadelphia, Pa.

PRESSURE BLOWERS

See Blowers, Pressure

PRESSURE CONTROLLERS

See Regulators, Pressure

PRESSURE GAGES

See Gages, Pressure

PRESSURE INDICATOR-CONTROLLERS

See Indicator-Controllers, Pressure

PRESSURE RECORDER-CONTROLLERS

See Recorder-Controllers, Pressure

PRESSURE RECORDERS

See Recorders, Pressure

PRESSURE REDUCING VALVES

See Valves, Pressure Reducing and Regulating

PRESSURE REGULATING VALVES

See Valves, Pressure Reducing and Regulating

PRESSURE REGULATORS

See Regulators, Pressure

PRESSURE SWITCHES

See Switches, Pressure and Vacuum

PROCESS HEATING SYSTEMS

See Systems, Process Heating, High Temperature

PROCESS AND STORAGE TANKS

See Tanks, Process and Storage

PROPELLER FANS

See Fans, Propeller

PROTECTORS, PIPE COVERING

Carpenter & Paterson, Inc., East Boston, Mass.
Cheney Co., Philadelphia, Pa.
●Grinnell Co., Inc., Providence, R. I.

PSYCHROMETERS, INDICATING

American Moistening Co., Providence, R. I.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Chisholm Co., Allen E., Portland, Ore.

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Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hill, E. Vernon, Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Parks-Cramer Co., Fitchburg, Mass.
●Taylor Instrument Companies, Rochester, N. Y.

PSYCHROMETERS, RECORDING

Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
H-B Instrument Co., Philadelphia, Pa.
Hill, E. Vernon, Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Moeller Instrument Co., Richmond Hill, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

PSYCHROSTATS

See Humidistats

PUMP BASES

See Bases and Pads, Vibration Isolating

PUMPS, AIR

Beach-Russ Co., New York, N. Y.
●Brunner Mfg. Co., Utica, N. Y.
Chicago Pneumatic Tool Co., New York, N. Y.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Davidson Co., M. T., New York, N. Y.
DeVilbiss Co., The, Toledo, O.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Kellogg Compressor & Mfg. Corp., Rochester, N. Y.
Kraissl Co., Inc., The, Hackensack, N. J.
Leiman Bros., Inc., Newark, N. J.
●Nash Engineering Co., South Norwalk, Conn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Roots-Connersville Blower Corp., Connersville, Ind.
Skidmore Corp., St. Joseph, Mich.
Trimount Rotary Power Co., East Dedham, Mass.
Uniflow Mfg. Co., Erie, Pa.
Union Steam Pump Co., Battle Creek, Mich.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, BOILER FEED

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
Berns Specialty Co., Chicago, Ill.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Cissell Mfg. Co., W. M., Louisville, Ky.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y
Dayton-Dowd Co., Quincy, Ill.
Dean Bros. Co., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
Deming Co., Salem, O.
Eclipse Fuel Engineering Co., Rockford, Ill.
Economy Pumps, Inc., Chicago, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Wheeler Corp., New York, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y. ✓
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Johnson Corp., Three Rivers, Mich.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kisco Co., Inc., St. Louis, Mo.
Kraissl Co., Inc., The, Hackensack, N. J.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
McGowan Co., John H., Cincinnati, O.
Micro-Westco, Inc., Bettendorf, Ia.
Morehead Mfg. Co., Detroit, Mich.
Morris Machine Works, Baldwinsville, N. Y.
●Nash Engineering Co., South Norwalk, Conn.
Roots-Connersville Blower Corp., Connersville, Ind.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Union Steam Pump Co., Battle Creek, Mich.
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
Warren Steam Pump Co. Inc., Warren, Mass.
Weil Pump Co., Chicago, Ill.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CENTRIFUGAL

Aldrich Pump Co., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
Barrett, Haentjens & Co., Hazelton, Pa.
Beach-Russ Co., New York.
Berns Specialty Co., Chicago, Ill.
Blaisdell Compressor Co., New York, N. Y.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Byron Jackson Co., Los Angeles, Cal.
Chain Belt Co., Milwaukee, Wis.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y
Dayton-Dowd Co., Quincy, Ill.
Dean Bros. Co., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
Economy Pumps, Inc., Chicago, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Wheeler Corp., New York, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Fulflo Specialties Co., Inc., Blanchester, O.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kraissl Co., Inc., The, Hackensack, N. J.
La Bour Pump Co., Inc., Elkhart, Ind.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
McGowan Co, John H., Cincinnati, O.
Micro-Westco, Inc., Bettendorf, Ia.
Morris Machine Wks., Baldwinsville, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Palmer Electric Co., Detroit, Mich.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Quimby Pump Co., Inc., Newark, N. J.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schwitzer-Cummins Co., Indianapolis, Ind.
Swaby Mfg. Co., Chicago, Ill.
Taber Pump Co., Buffalo, N. Y.
●Trane Co., La Crosse, Wis.
Union Steam Pump Co., Battle Creek, Mich.
United Motors Service Co., Detroit, Mich.
Utility Fan Corp., Los Angeles, Cal.
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
Warren Steam Pump Co., Inc., Warren, Mass.
Weil Pump Co., Chicago, Ill.
Weinman Pump Mfg. Co., Columbus, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CONDENSATION RETURN

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●American District Steam Co., North Tonawanda, N. Y.
American-Marsh Pumps, Inc., Battle Creek, Mich.
American Radiator Co., New York, N. Y.
Aurora Pump Co., Aurora, Ill.
Berns Specialty Co., Chicago, Ill.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Byron Jackson Co., Los Angeles, Cal.
Chicago Pump Co., Chicago, Ill.
Cissell Mfg. Co., W. M., Louisville, Ky.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y
Dayton-Dowd Co., Quincy, Ill.
Dean Bros. Co., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Economy Pumps, Inc., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Wheeler Corp., New York, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Goulds Pumps, Inc., Seneca Falls, N. Y. ✓

● Advertisement in this issue. See Index to Advertisers, page 168.

Guild & Garrison, Inc., Brooklyn, N. Y.
Heating Assurance, Inc., Spokane, Wash.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Ingersoll-Rand, New York, N. Y.
Johnson Corp., Three Rivers, Mich.
Kisco Co., Inc., St. Louis, Mo.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
McGowan Co., John H., Cincinnati, O.
Micro-Westco, Inc., Bettendorf, Ia.
Morehead Mfg. Co., Detroit, Mich.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
National Steam Pump Co., Upper Sandusky, O.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Quimby Pump Co., Inc., Newark, N. J.
Roots-Connersville Blower Corp., Connersville, Ind.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Skidmore Corp., St. Joseph, Mich.
Sterling Engineering Co., Milwaukee, Wis.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Swaby Mfg. Co., Chicago, Ill.
●Trane Co., La Crosse, Wis.
Warren Steam Pump Co., Inc., Warren, Mass.
Weil Pump Co., Chicago, Ill.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, DEEP WELL, TURBINE

American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Aurora Pump Co., Aurora, Ill.
Caldwell, Farley M., Fort Wayne, Ind.
Columbus Steam Pump Wks. Co., Columbus, O.
●Crane Co., Chicago, Ill.
Davidson Co., M. T., New York, N. Y
Deming Co., Salem, O.
Duro Co., Dayton, O.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Pumps, Inc., Seneca, N. Y. ✓ FALLS
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
●Layne & Bowler, Inc., Memphis, Tenn.
Myers & Bro. Co., F. E., The, Ashland, O.
Micro-Westco, Inc., Bettendorf, Ia.
Peerless Pump Div., Food Machinery Corp., Massillon, O.
Pomona Pump Co., Pomona, Cal.
Red Jacket Pump Co., Davenport, Ia.
Roper Corp., Geo. D., Rockford, Ill.
Rumsey Pump Corp., Seneca Falls, N. Y. ✓
Uniflow Mfg. Co., Erie, Pa.
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, FIRE

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Dayton-Dowd Co., Quincy, Ill.
Economy Pumps, Inc., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y. ✓
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Lecourtenay Co., Newark, N. J.
McGowan Co., John H., Cincinnati, O.
Morris Machine Wks., Baldwinsville, N. Y.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Robbins & Myers, Inc., Springfield, O.
Rumsey Pump Corp., Seneca Falls, N. Y. ✓
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
Viking Pump Co., Cedar Falls, Ia.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, HYDRAULIC

Aldrich Pump Co., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
Bishop & Babcock Mfg. Co., Cleveland, O.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y
Dean Bros. Co., Indianapolis, Ind.
Goulds Pumps, Inc., Seneca Falls, N. Y. ✓
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Lawrence Pump & Engine Co., Lawrence, Mass.
National Steam Pump Co., Upper Sandusky, O.
Robbins & Myers, Inc., Springfield, O.
Roper Corp., Geo. D., Rockford, Ill.
Rumsey Pump Corp., Seneca Falls, N. Y. ✓
Sundstrand Machine Tool Co., Rockford, Ill.
Union Steam Pump Co., Battle Creek, Mich.
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
Viking Pump Co., Cedar Falls, Ia.
●Watson-Stillman Co., Roselle, N. J.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, RECIPROCATING

Aldrich Pump Co., Allentown, Pa.
Allis-Chalmers Mfg Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Columbus Steam Pump Wks., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dean Bros. Co., Indianapolis, Ind.
Deming Co., Salem, O.
Domestic Engine & Pump Co., New York, N. Y.
Fairbanks-Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y. ✓
Guild & Garrison, Inc., Brooklyn, N. Y.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Ingersoll-Rand, New York, N. Y.
McGowan Co., John H., Cincinnati, O.
National Steam Pump Co., Upper Sandusky, O.
Rumsey Pump Corp., Seneca Falls, N. Y.
Uniflow Mfg. Co., Erie, Pa.
Union Steam Pump Co., Battle Creek, Mich.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, ROTARY

American Hard Rubber Co., New York, N. Y. (Hard Rubber)
Beach-Russ Co., New York, N. Y.
Blackmer Pump Co., Grand Rapids, Mich.
Davidson Co., M. T., New York, N. Y.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Gould Pumps, Inc., Seneca Falls, N. Y.
Johnston & Jennings Co., Cleveland, O.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Logan Engineering Co., Chicago, Ill. (Radial diaphragm)
Martocello & Co., Jos. A., Philadelphia, Pa.
McGowan Co., John H., Cincinnati, O.
●Monarch Mfg. Wks., Inc., Philadelphia, Pa.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Quimby Pump Co., Inc., Newark, N. J.
Robbins & Myers, Inc., Springfield, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Roper Corp., Geo. D., Rockford, Ill.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sundstrand Machine Tool Co., Rockford, Ill.
Taber Pump Co., Buffalo, N. Y.
Trimount Rotary Power Co., East Dedham, Mass.
Tuthill Pump Co., Chicago, Ill.
Viking Pump Co., Cedar Falls, Ia.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yale & Towne Mfg. Co., Stamford, Conn.

PUMPS, STEAM

American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dean Bros. Co., Indianapolis, Ind.
Domestic Engine & Pump Co., New York, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
McGowan Co., John H., Cincinnati, O.
National Steam Pump Co., Upper Sandusky, O.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weinman Pump Co., Columbus, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, SUMP

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
Berns Specialty Co., Chicago, Ill.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pneumatic Tool Co., New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.

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Dayton-Dowd Co., Quincy, Ill.
Dean Hill Pump Co., Anderson, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., New York, N. Y.
Economy Pumps, Inc., Chicago, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand, New York, N. Y.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kisco Co., Inc., St. Louis, Mo.
Lawrence Pump & Engine Co., Lawrence, Mass.
McGowan Co., John H., Cincinnati, O.
Micro-Westco, Inc., Bettendorf, Ia.
Morehead Mfg. Co., Detroit, Mich.
Morris Machine Wks., Baldwinsville, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Penberthy Injector Co., Detroit, Mich.
Pomona Pump Co., Pomona, Cal.
Quimby Pump Co., Inc., Newark, N. J.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schneible Co., Claude B., Chicago, Ill.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Swaby Mfg. Co., Chicago, Ill.
Taber Pump Co., Buffalo, N. Y.
Uniflow Mfg. Co., Erie, Pa.
Union Steam Pump Co., Battle Creek, Mich.
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
Weil Pump Co., Chicago, Ill.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, VACUUM

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Barrett, Haentjens & Co., Hazelton, Pa.
Beach-Russ Co., New York, N. Y.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Chicago Pneumatic Tool Co., New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Davidson Co., M. T., New York, N. Y.
Dean Bros. Co., Indianapolis, Ind.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Domestic Engine & Pump Co., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
Economy Pumps, Inc., Chicago, Ill.
Eisler Engineering Corp., Newark, N. J.
Elliott Co., Jeannette, Pa.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Foster Wheeler Corp., New York, N. Y.
Fuller Co., Catasauqua, Pa.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Ingersoll-Rand, New York, N. Y.
Johnson Corp., Three Rivers, Mich.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Leiman Bros., Inc., Newark, N. J.
McGowan Co., John H., Cincinnati, O.
●Nash Engineering Co., South Norwalk, Conn.
National Steam Pump Co., Upper Sandusky, O.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Robbins & Myers, Inc., Springfield, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Schutte & Koerting Co., Philadelphia, Pa.
Skidmore Corp., St. Joseph, Mich.
Sterling Engineering Co., Milwaukee, Wis.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Union Steam Pump Co., Battle Creek, Mich.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, VISCOUS LIQUIDS AND HEAVY MATERIALS

Aldrich Pump Co., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Austin-Mason Co., New York, N. Y.
Beach-Russ Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chain Belt Co., Milwaukee, Wis.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dean Bros. Co., Indianapolis, Ind.
Economy Pumps, Inc., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Frederick Iron & Steel Co., Frederick, Md.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Ingersoll-Rand, New York, N. Y.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kinney Mfg. Co., Boston, Mass.
Lawrence Pump & Engine Co., Lawrence, Mass.
McGowan Co., John H., Cincinnati, O.
Morris Machine Wks., Baldwinsville, N. Y.
Quimby Pump Co., Inc., Newark, N. J.
Robbins & Myers, Inc., Springfield, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Roper Corp., Geo. D., Rockford, Ill.
Rumsey Pump Corp., Seneca Falls, N. Y.
Taber Pump Co., Buffalo, N. Y.
Union Steam Pump Co., Battle Creek, Mich.
Victor Equipment Co., Kimball-Krogh Pump Div., Los Angeles, Cal.
Viking Pump Co., Cedar Falls, Ia.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUNCHES, SHEET METAL

Bertsch & Co., Inc., Cambridge City, Ind.
●Buffalo Forge Co., Buffalo, N. Y.
Hendley & Wittemore Co., Beloit, Wis.
International Nutyp Tool Corp., Oswego, N. Y.
Kidder Mfg. Co., Inc., J. F., Burlington, Vt.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Parker-Kalon Corp., New York, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Pels & Co., Inc., Henry, New York, N. Y.
Whitney Mfg. Co., W. A., Rockford, Ill.
●Whitney Metal Tool Co., Rockford, Ill.
Wiedemann Machine Co., Philadelphia, Pa.
Zeh & Hanemann Co., Newark, N. J.

QUADRANTS, DAMPER

Air Conditioning Products Co., Detroit, Mich.
●Hart & Cooley Mfg. Co., Chicago, Ill.
Jacobs Co., B. & J., Cincinnati, O.
Northern Weatherstrip Co., Duluth, Minn.
Ohio Products Co., Cleveland, O.
Parker-Kalon Corp., New York, N. Y.
Spence Engineering Co., Inc., Walden, N. Y.
United States Register Co., Battle Creek, Mich.
Young Regulator Co., Cleveland, O.

RADIATION, CONVECTION TYPE, CAST IRON

American Radiator Co., New York, N. Y.
●Crane Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Smith Co., H. B., Westfield, Mass.
●Unit Heater & Cooler Co., Wausau, Wis.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago, Ill.

RADIATION, CONVECTION TYPE, NON-FERROUS

American Radiator Co., New York, N. Y.
Bush Mfg. Co., Hartford, Conn.
Commodore Heaters Corp., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
●G. & O. Mfg. Co., New Haven, Conn.
●Grinnell Co., Inc., Providence, R. I.
Manufacturers Fin Coil Co., Chicago, Ill.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
●Refrigeration Economics Co., Inc., Canton, O.
Rome-Turney Radiator Co., Rome, N. Y.
Super Radiator Corp., Minneapolis, Minn.
●Trane Co., La Crosse, Wis.
Vulcan Radiator Co., Hartford, Conn.
●Webster & Co., Warren, Camden, N. J.
●Young Radiator Co., Racine, Wis.

RADIATION, DIRECT

American Radiator Co., New York, N. Y.
●Burnham Boiler Corp., Irvington, N. Y.
Clow & Sons, Jas. B., Chicago, Ill. (Gas fired)
Columbia Radiator Co., McKeesport, Pa.
●Crane Co., Chicago, Ill.
Fowler & Wolfe Radiator Co., Norristown, Pa.
Hart & Crouse Corp., Utica, N. Y.
International Heater Co., Utica, N. Y.
Logansport Radiator Equipment Co., Logansport, Ind.
National Radiator Corp., Johnstown, Pa.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Inc., Frank, Terre Haute, Ind.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
●Shaw-Perkins Mfg. Co., Pittsburgh, Pa.
Slater Mfg. Co., Wakefield, Mass. (Baseboard).
Smith Co., H. B., Westfield, Mass.
Thatcher Furnace Co., Newark, N. J.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago, Ill.

RADIATOR HANGERS

See Hangers or Brackets, Radiator

● Advertisement in this issue. See Index to Advertisers, page 168.

RADIATOR VALVES

See Valves, Radiator

RATCHET WRENCHES

See Wrenches, Ratchet

REAMERS, PIPE

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Crown Die & Tool Co., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Mueller Co., Decatur, Ill.
Nye Tool & Machine Wks., The, Chicago, Ill.
Toledo Pipe Threading Machine Co., Toledo, O.
Walworth Co., New York, N. Y.

RECIPROCATING PUMPS

See Pumps, Reciprocating

RECORDER-CONTROLLERS, COMBINED TEMPERATURE AND HUMIDITY

Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div., of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Mason-Neilan Regulator Co., Boston, Mass.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

RECORDER-CONTROLLERS, HUMIDITY

Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Mason-Neilan Regulator Co., Boston, Mass.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

RECORDER-CONTROLLERS, PRESSURE

Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

RECORDER-CONTROLLERS, TEMPERATURE

Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Wheelco Instruments Co., Chicago, Ill.

RECORDERS, COMBINED TEMPERATURE AND HUMIDITY

Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

RECORDERS, COMBUSTION

Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Engelhard, Inc., Charles, Newark, N. J.
Foxboro Co., Foxboro, Mass.
Hays Corp., Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Uehling Instrument Co., Paterson, N. J.

RECORDERS, DRAFT

Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co, Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Foxboro Co., Foxboro, Mass.
Hays Corp., Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Mason-Neilan Regulator Co., Boston, Mass.
Republic Flow Meters Co., Chicago, Ill.
Uehling Instrument Co., Paterson, N. J.

RECORDERS, HUMIDITY

Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
H-B Instrument Co., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

RECORDERS, LIQUID LEVEL

Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Morey & Jones, Ltd., Los Angeles, Calif.
Paragon Electric Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

RECORDERS, PRESSURE

Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Foxboro Co., Foxboro, Mass.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.

RECORDERS, TEMPERATURE

Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Engelhard, Inc., Charles, Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
H-B Instrument Co., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Liquidometer Corp., Long Island City, N. Y.

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Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
●Powers Regulator Co., Chicago, Ill.
●Practical Instrument Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.

RECORDERS, VACUUM

Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Foxboro Co., Foxboro, Mass.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budendberg Instrument Div., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.

RECORDING THERMOMETERS

See Thermometers, Recording

REDUCERS, SPEED

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Boston Gear Wks., Inc., North Quincy, Mass.
De Laval Steam Turbine Co., Trenton, N. J.
Diehl Mfg. Co., Elizabeth, N. J.
General Electric Co., Schenectady, N. Y.
Ideal Commutator Dresser Co., Sycamore, Ill.
Janette Mfg. Co., Chicago, Ill. (Motorized)
Jones Foundry Machine Co., W. A., Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Medart Co., St. Louis, Mo.
Morse Chain Co., Ithaca, N. Y. (Chain speed)
New Departure Div., General Motors Corp., Bristol, Conn.
Philadelphia Gear Co., Philadelphia, Pa.
Star Electric Motor Co., Bloomfield, N. J.
Poole Foundry & Machine Co., Baltimore, Md.
Smith, Inc., Winfield H., Springville, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

REFRIGERANTS

Ansul Chemical Co., Marinette, Wis. (methyl chloride, sulphur dioxide)
Armour Ammonia Wks., Chicago, Ill. (ammonia)
Carbide & Carbon Chemicals Corp., New York, N. Y. (Butane, isobutane, propane, ethane)
du Pont de Nemours & Co., E. I. R. & H. Chemicals Dept., Wilmington, Del. (methyl chloride)
du Pont de Nemours & Co., National Ammonia Div., Wilmington, Del. (ammonia, sulphur dioxide)
●Kinetic Chemicals, Inc., Wilmington, Del. ("Freon")
Liquid Carbonic Corp., Chicago, Ill. (carbon dioxide)
Pennsylvania Salt Mfg. Co., Philadelphia, Pa. (ammonia)
Pure Carbonic, Inc., New York, N. Y. (carbon dioxide)
Virginia Smelting Co., West Norfolk, Va. (methyl chloride)

REFRIGERATING COMPRESSORS

See Compressors, Refrigerating

REFRIGERATING VALVES

See Valves, Refrigeration

REFRIGERATION CONTROLS

See Valves, Refrigeration

REFRIGERATION FITTINGS

See Fittings, Refrigeration

REFRIGERATION MANIFOLDS

See Manifolds, Refrigeration

REFRIGERATION VALVES

See Valves, Refrigeration

REGISTERS

Air Control Products, Inc., Muskegon, Mich.
●Auer Register Co., Cleveland, O.
Barber-Colman Co., Rockford, Ill.
Best Register Co., Milwaukee, Wis.
Diamond Mfg. Co., Wyoming, Pa.
Elsey Metal Specialties Co., Detroit, Mich.
Gillian Mfg. Co., Ferndale, Mich.
●Hart & Cooley Mfg. Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
●Independent Register Co., Cleveland, O.
Knowles Mushroom Ventilator Co., New York, N. Y.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Register & Grille Mfg. Co., Brooklyn, N. Y.
Rock Island Register Co., Rock Island, Ill.
●Tuttle & Bailey, Inc., New Britain, Conn.
United States Register Co., Battle Creek, Mich.
●Waterloo Register Co., Waterloo, Ia.

REGULATORS, AIR VELOCITY

Air Control Products, Inc., Muskegon, Mich.
●Johnson Service Co., Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.

REGULATORS, DRAFT

Air Conditioning Products Co., Detroit, Mich.
American Radiator Co., New York, N. Y.
Askania Regulator Co., Chicago, Ill.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Bailey Meter Co., Cleveland, O.
Boiler Room Equipment, Inc., New York, N. Y.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burrows Mfg. Co., F. A., York, Pa.
●Cash Co., A. W., Decatur, Ill.
Cole-Sullivan Engineering Co., Minneapolis, Minn.
Crew-Equipment Co., Inc., New York, N. Y.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Engineer Co., New York, N. Y.
Field Mfg. Co., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Hagan Corp., Pittsburgh, Pa.
Hays Corp., Michigan City, Ind.
Hotstream Heater Co., Cleveland, O.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
Master Electric Co., Dayton, O.
Mercoid Corp., Chicago, Ill.
National Brass Co., Grand Rapids, Mich.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
Republic Flow Meters Co., Chicago, Ill. (Industrial)
Ruggles-Klingeman Mfg. Co., Salem, Mass.
●Sarco Co., Inc., New York, N. Y.
Shallcross Controls, Inc., Milwaukee, Wis.
Sheer Co., H. M., Quincy, Ill.
Spence Engineering Co., Inc., Walden, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Webster & Co., Warren, Camden, N. J.
●White-Rodgers Electric Co., St. Louis, Mo.

REGULATORS, PRESSURE, AIR

Askania Regulator Co., Chicago, Ill.
Bastian-Blessing Co., Chicago, Ill.
Boylston Steam Specialty Co., Chicago, Ill.
Brooke Engineering Co., Inc., Philadelphia, Pa.
●Brunner Mfg. Co., Utica, N. Y.
Cash Universal Regulator Co., Marshalltown, Ia.
Cooper Co., Clark, Philadelphia, Pa.
Davis Regulator Co. Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
DeVilbiss Co., The, Toledo, O.
Dockson Co., C. H., Detroit, Mich.
Foster Engineering Co., Newark, N. J.
●Illinois Engineering Co., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Schade Valve Mfg. Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Spray Engineering Co., Somerville, Mass.
Square D Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.

REGULATORS, PRESSURE, GAS

Askania Regulator Co., Chicago, Ill.
Atlas Valve Co., Inc., Newark, N. J.
Barber Gas Burner Co., Cleveland, O.
Bastian-Blessing Co., Chicago, Ill.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.

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Brooke Engineering Co., Inc., Philadelphia, Pa.
Bryant Heater Co., The, Cleveland, O.
Brown Instrument Co., Div. of Minneapolis-Regulator Co., Philadelphia, Pa.
Burdett Mfg. Co., Chicago, Ill.
●Cash Co., A. W., Decatur, Ill.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Philadelphia, Pa.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
Dockson Co., C. H., Detroit, Mich.
Eclipse Fuel Engineering Co., Rockford, Ill.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
Gasweld Equipment Co., Chicago, Ill.
General Controls Co., Glendale, Cal.
Harris Calorific Co., Cleveland, O.
●Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
●Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Milburn Co., Alexander, Baltimore, Md.
Monitor Controller Co., Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal. (Low)
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
●Powers Regulator Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill. (Industrial)
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Sheer Co., H. M., Quincy, Ill.
Spence Engineering Co., Inc., Walden, N. Y.
Square D Co., Detroit, Mich.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Torchweld Equipment Co., Chicago, Ill.
Trerice Co., H. O., Detroit, Mich.
Watson & McDaniel Co., Philadelphia, Pa.
●White-Rodgers Electric Co., St. Louis, Mo.
●York Ice Machinery Corp., York, Pa.

REGULATORS, PRESSURE, HOT WATER HEATING SYSTEMS

Atlas Valve Co., Inc., Newark, N. J.
Au-Temp-Co Corp., New York, N. Y.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Belfield Co., H., Philadelphia, Pa.
●Bell & Gossett Co., Chicago, Ill.
Bordo Co., Inc., L. J., Glenside, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Cash Universal Regulator Co., Marshalltown, Ia.
Cooper Co., Clark, Philadelphia, Pa.
d'Este Co., Julian, Charlestown, Mass.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
●Fulton Sylphon Co., Knoxville, Tenn.
●Illinois Engineering Co., Chicago, Ill.
Kainer Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Leslie Co., Lyndhurst, N. J.
●Maid-O-Mist, Inc., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Penberthy Injector Co., Detroit, Mich.
Republic Flow Meters Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Stevens-Root Co., Chicago, Ill.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.
Trerice Co., H. O., Detroit, Mich.
Triplex Mfg. Co., Peru, Ind.
Tryco Products, Inc., Westfield, Mass.
United Electric Controls Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.
●White-Rodgers Electric Co., St. Louis, Mo.

REGULATORS, PRESSURE, LIQUID

Atlas Valve Co., Inc., Newark, N. J.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Central Brass Mfg. Co., Cleveland, O.
Cooper Co., Clark, Philadelphia.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
●Fulton Sylphon Co., Knoxville, Tenn.
Healy Ruff Co., St. Paul, Minn.
●Illinois Engineering Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Monarch Mfg. Wks., Inc., Philadelphia, Pa.
Monitor Controller Co., Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Norgren Co., Inc., C. A., Denver, Colo.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Square D Co., Detroit, Mich.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Tryco Products, Inc., Westfield, Mass.
United Electric Controls Co., Boston, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, PRESSURE, STEAM

●American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Atlas Valve Co., Inc., Newark, N. J.
Bailey Meter Co., Cleveland, O.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burrows Mfg. Co., F. A., York, Pa.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Philadelphia.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
●Dunham Co., C. A., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Engineer Co., New York, N. Y.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
●Fulton Sylphon Co., Knoxville, Tenn.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Gorton Heating Corp., Cranford, N. J.
Hays Corp., Michigan City, Ind.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Kisco Co., Inc., St. Louis, Mo.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Monitor Controller Co., Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
National Brass Co., Grand Rapids, Mich.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.

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Norgren Co., Inc., C. A., Denver, Colo.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
United Electric Controls Co., Boston, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
●White-Rodgers Electric Co., St. Louis, Mo.
Williams Gauge Co., Pittsburgh, Pa.

REGULATORS, STATIC PRESSURE

Eclipse Fuel Engineering Co., Rockford, Ill.
Foster Engineering Co., Newark, N. J.
●Johnson Service Co., Milwaukee, Wis.
Leslie Co., Lyndhurst, N. J.
Mason-Neilan Regulator Co., Boston, Mass.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.
●White-Rodgers Electric Co., St. Louis, Mo.

REGULATORS, TEMPERATURE

American Radiator Co., New York, N. Y.
Atlas Valve Co., Inc., Newark, N. J.
Au-Temp-Co. Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burling Instrument Co., Newark, N. J.
Cook Electric Co., Chicago, Ill.
Cooper Co., Clark, Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
Eclipse Fuel Engineering Co., Rockford, Ill.
Edison, Inc., Thomas A., Edison Electrical Controls Div., West Orange, N. J.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
●Fulton Sylphon Co., Knoxville, Tenn.
General Controls Co., Glendale, Cal.
H-B Instrument Co., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Keckley Co., O. C., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Marsh Tritrol Co., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Mercoid Corp., Chicago, Ill.
Monitor Controller Co., Baltimore, Md.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
●Powers Regulator Co., Chicago, Ill.
Ranco, Inc., Columbus, O.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., Inc., New York, N. Y.
Spence Engineering Co., Inc., Walden, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Detroit, Mich.
Sterling Engineering Co., Milwaukee, Wis.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
United Electric Controls Co., Boston, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Wheelco Instruments Co., Chicago, Ill.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.

RELAYS, ELECTRICAL

Advance Electric Co., Los Angeles, Cal.
Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Elect. Co., Hartford, Conn.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
●Bell & Gossett Co., Chicago, Ill.
Bender Warrick Corp., Birmingham, Mich.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Clark Controller Co., Cleveland, O.
Cutler-Hammer, Inc., Milwaukee, Wis.
Dunn, Inc., Struthers, Philadelphia, Pa.
Durakool, Inc., Elkhart, Ind.
Electric Controller & Mfg. Co., Cleveland, O.
Friez & Sons, Julien P., Baltimore, Md.
General Controls Co., Glendale, Cal.
General Electric Co., Schnectady, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hart Mfg. Co., Hartford, Conn.
McCorkle Co., D. H., Berkeley, Calif.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., Baltimore, Md.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Milwaukee, Wis.
Tork Clock Co., Inc., Mount Vernon, N. Y.
Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N. J.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.

RELIEF VALVES

See Valves, Relief

REPAIR CLAMPS, PIPE

See Clamps, Pipe Repair

REVOLVING DOORS

See Doors, Revolving

RING JOINTS

See Joints, Ring

ROD, WELDING

Air Reduction Sales Co., New York, N. Y.
●American Brass Co., Waterbury, Conn.
American Chain & Cable Co., Inc., Bridgeport, Conn.
American Steel & Wire Co., Cleveland, O.
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Crucible Steel Co. of America, New York, N. Y.
Duraloy Co., Pittsburgh, Pa. (Stainless)
Imperial Brass Mfg. Co., Chicago, Ill.
Laclede Steel Co., St. Louis, Mo.
●Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Maurath, Inc., Cleveland, O.
Milburn Co., Alexander, Baltimore, Md.
Page Steel & Wire Division of American Chain Co., Inc., Monessen, Pa.
●Republic Steel Corp., Cleveland, O.
●Revere Copper & Brass, Inc., New York, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Seneca Wire & Mfg. Co., Fostoria, O.
Sight Feed Generator Co., Richmond, Ind.
Una Welding, Inc., E. Cleveland, O.
United States Steel Corp., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

ROLLER BEARINGS

See Bearings, Roller

ROOF VENTILATORS

See Ventilators, Roof

ROOM HUMIDIFIERS

See Humidifiers, Unit, Room Type and Units, Air Conditioning, Comfort, Winter

ROOM THERMOSTATS

See Thermostats, Room or Wall

ROTARY PUMPS

See Pumps, Rotary

RUBBER BELTING

See Belting, Rubber

RUBBER PACKING

See Packing, Rubber

RUBBER PIPE

See Pipe, Hard Rubber

SEAMLESS PIPE

See Pipe, Seamless, Steel

SEPARATORS, AIR

Adams Co., R. P., Buffalo, N. Y.
American Injector Co., Detroit, Mich.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Bubar, Hudson H., New York, N. Y.
Centrifix Corp., Cleveland, O.
●Crane Co., Chicago, Ill.
DeVilbiss Co., The, Toledo, O.
Direct Separator Co., Inc., Syracuse, N. Y.
●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.

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Kellogg Compressor & Mfg. Corp., Rochester, N. Y.
Leavitt Machine Co., Orange, Mass.
Logan Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Milburn Co., Alexander, Baltimore, Md.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Spencer Turbine Co., Hartford, Conn.
Spray Engineering Co., Somerville, Mass.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Textite Corp., Chicago, Ill.
Trerice Co., H. O., Detroit, Mich.
Wright-Austin Co., Detroit, Mich.

SEPARATORS, STEAM AND OIL

Acme Industries, Inc., Jackson, Mich.
Adams Co., R. P., Buffalo, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
Barrett Machine Co., N. S. Pittsburgh, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Centrifix Corp., Cleveland, O.
●Cochrane Corp., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Direct Separator Co., Inc., Syracuse, N. Y.
Elliott Co., Jeannette, Pa.
Fisher Governor Co., Marshalltown, Ia.
●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
Kieley & Mueller, Inc., New York, N. Y.
Kisco Co., Inc., St. Louis, Mo.
Logan Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Morehead Mfg. Co., Detroit, Mich.
National Valve & Mfg. Co., Pittsburgh, Pa.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Richmond Engineering Co., Richmond, Va.
Schutte & Koerting Co., Philadelphia, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Textite Corp., Chicago, Ill.
●Webster & Co., Warren, Camden, N. J.
Westfalia Separator Co., Bloomfield, N. J.
Wright-Austin Co., Detroit, Mich.

SEWAGE EJECTORS

See Ejectors, Sewage

SHEARS, ELECTRIC, PORTABLE

G. D. S. Machinery & Supply Co., Inc., New York, N. Y.
Glascock Bros. Mfg. Co., Muncie, Ind.
Skilsaw, Inc., Chicago, Ill.
Stanley Works, New Britain, Conn.

SHEARS, HAND

Armstrong-Blum Mfg. Co., Chicago, Ill.
Black & Decker Mfg. Co., Towson, Md.
Bremil Mfg. Co., Erie, Pa.
Champion Blower & Forge Co., Lancaster, Pa.
Clauss Shear Co., Fremont, O.
Hendley & Whittemore, Beloit, Wis.
Marshalltown Mfg. Co., Marshalltown, Ia.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Pels & Co., Inc., Henry, New York, N. Y.
Snap-On Tools Corp., Kenosha, Wis.
Stanley Wks., New Britain, Conn.
Viking Shear Co., Erie, Pa.
Wallace Supplies Mfg. Co., Chicago, Ill.
Whitney Mfg. Co., W. A., Rockford, Ill.
●Whitney Metal Tool Co., Rockford, Ill.
Wiss & Sons Co., J., Newark, N. J.

SHEARS, POWER

Beatty Machine & Mfg. Co., Hammond, Ind.
Bertsch & Co., Inc., Cambridge City, Ind.
Bliss Co., E. W., Toledo, O.
●Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Dreis & Krump Mfg. Co., Chicago, Ill.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Heartley Machine & Tool Co., Toledo, O.
Hendley & Whittemore, Beloit, Wis.
Libert Machine Co., Green Bay, Wis. (Rapid Cutting)
Marshalltown Mfg. Co., Marshalltown, Ia.
New Albany Machine Mfg. Co., New Albany, Ind.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Pels & Co., Inc., Henry, New York, N. Y.
Quickwork Co., Chicago, Ill.
Rock River Machine Co., Inc., Janesville, Wis.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Yoder Co., Cleveland, O.

SHEET METAL BRAKES

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SHEET METAL DUCTS

See Ducts and Duct Fittings, Prefabricated

SHEET METAL FITTINGS

See Ducts and Duct Fittings, Prefabricated

SHEET METAL PUNCHES

See Punches, Sheet Metal

SHEETS, ALLOY

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
●American Brass Co., Waterbury, Conn.
●American Rolling Mill Co., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Colonial Alloys Co., Specialties Div., Philadelphia, Pa.
Crucible Steel Co. of America, New York, N. Y.
Duraloy Co., Pittsburgh, Pa. (Stainless)
Duriron Co., Inc., Dayton, O.
Flemm Lead Co., Inc., Long Island City, N. Y. (Antimonial)
Ingersoll Steel & Disc Co., Chicago, Ill.
International Nickel Co., New York, N. Y. (Monel)
Lukens Steel Co., Coatesville, Pa.
●Republic Steel Corp., Cleveland, O.
●Revere Copper & Brass, Inc., New York, N. Y. (Brass, bronze)
Scovill Mfg. Co., Waterbury, Conn.
Sharon Steel Corp., Sharon, Pa.
United States Steel Corp., Pittsburgh, Pa.

SHEETS, ALUMINUM

Aluminum Co. of America, Pittsburgh, Pa.
Fairmont Aluminum Co., Fairmont, W. Va.

SHEETS, COPPER

●American Brass Co., Waterbury, Conn.
American Nickeloid Co., Peru, Ind. (Chromium plated)
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Hussey & Co., C. G., Pittsburgh, Pa.
National Brass & Copper Co., Inc., Lisbon, O.
New Haven Copper Co., Seymour, Conn.
●Revere Copper & Brass, Inc., New York, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
United States Brass & Copper Co., Hyde Park, Boston, Mass.

SHEETS, COPPER BEARING STEEL

●American Rolling Mill Co., Middletown, O.
Apollo Steel Co., Apollo, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Follansbee Bros. Co., Pittsburgh, Pa.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Lukens Steel Co., Coatesville, Pa.
National Steel Corp., Pittsburgh, Pa.
Newport Rolling Mill Co., Newport, Ky.
Otis Steel Co., Cleveland, O.
Reeves Steel & Mfg. Co., Dover, O.
●Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., The, Canton, O.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
United States Steel Corp., Pittsburgh, Pa.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS, LEAD

Andrews Lead Co., Long Island City, N. Y.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.
Rochester Lead Wks. Rochester, N. Y.

SHEETS, STEEL, GALVANIZED

American Nickeloid Co., Peru, Ind. (Chromium plated)
●American Rolling Mill Co., Middletown, O.
Apollo Steel Co., Apollo, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Byers Co., A. M., Pittsburgh, Pa. (Wrought iron)
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, New York, N. Y.
Follansbee Bros. Co., Pittsburgh, Pa.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Lukens Steel Co., Coatesville, Pa.
Lyon, Conklin & Co., Inc., Baltimore, Md.
National Steel Corp., Pittsburgh, Pa.
Newport Rolling Mill Co., Newport, Ky.
Niles Rolling Mill Co., Niles, O.
Reeves Steel & Mfg. Co., Dover, O.
●Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., The, Canton, O.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
United States Steel Corp., Pittsburgh, Pa.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

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SHEETS, TIN

Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Follansbee Bros. Co., Pittsburgh, Pa.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
National Lead Co., New York, N. Y.
United States Steel Corp., Pittsburgh, Pa.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS, ZINC

American Nickeloid Co., Peru, Ind. (Chromium plated)
American Zinc Products Co., Greencastle, Ind.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Hegeler Zinc Co., Danville, Ill.
Illinois Zinc Co., Chicago, Ill.
Matthiessen & Hegeler Zinc Co., La Salle, Ill.
New Jersey Zinc Sales Co., New York, N. Y.

SHUTTERS

See Louvers and Shutters

SLEEVE BEARINGS

See Bearings, Sleeve

SMOKE GUNS

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SMUDGE POTS

See Guns and Pots, Smoke and Smudge

SOCKET WRENCHES

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SOLDER, BRAZING ALLOYS, AND FLUXES

Air Reduction Sales Co., New York, N. Y.
●American Brass Co., Waterbury, Conn.
American Solder & Flux Co., Philadelphia, Pa.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Benson Co., Inc., Alex R., Hudson, N. Y.
Burnley Battery & Mfg. Co., North East, Pa.
Eagle-Picher Lead Co., Cincinnati, O.
Gardiner Metal Co., Chicago, Ill.
Handy & Harman, New York, N. Y. (Silver)
Imperial Brass Mfg. Co., Chicago, Ill.
Kester Solder Co., Chicago, Ill.
●Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.
Ruby Chemical Co., Columbus, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SOLENOID VALVES

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SOOT BLOWERS

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SOUND DEADENING, CEILING AND WALL

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SOUND DEADENING FOR DUCTS

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SOUND INDICATORS

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SPEED CHANGERS

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SPEED REDUCERS

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SPIRAL PIPE

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SPOT WELDERS

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SPRAY HUMIDIFIERS

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SPRAY NOZZLES

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SPRINKLER HEADS

See Heads, Sprinkler

SPRINKLER SYSTEM CONTROLS

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STAINLESS SHEETS

See Sheets, Alloy

STANDS, VISE

American Pipe Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Crown Die & Tool Co., Chicago, Ill.
Hollands Mfg. Co., Erie, Pa.
Martin & Sons, H. P., Owensboro, Ky.
Nye Tool & Machine Wks., The, Chicago, Ill.
Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O.
Western Wire Products Co., St. Louis, Mo.
●Williams & Co., J. H., New York, N. Y.

STARTERS, MOTOR

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STEAM EJECTORS

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STEAM ENGINES

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STEAM JET REFRIGERATION

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STEAM PRESSURE REGULATORS

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STEAM PUMPS

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STEAM SEPARATORS

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STEAM TRAPS

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STEEL PIPE

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STEEL TUBING

See Tubing, Steel

STEEL UNIONS

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STEEL VALVES

See Valves, Gate and Valves, Globe

STERILIZING LAMPS

See Lamps, Sterilizing, for Duct Installation

STOCKS AND DIES

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Champion Blower & Forge Co., Lancaster, Pa.
Crown Die & Tool Co., Chicago, Ill.
Erie Tool Wks., Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
Jarecki Mfg. Co., Erie, Pa.
Nye Tool & Machine Wks., The, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O.
Walworth Co., New York, N. Y.

STOKERS, INDUSTRIAL AND COMMERCIAL

American Coal Burner Co., Chicago, Ill.
Anchor Stove & Range Co., New Albany, Ind.
Auburn Foundry, Inc., Stoker Div., Auburn, Ind.
Automatic Stoker Corp., Milwaukee, Wis.
Babcock & Wilcox Co., New York, N. Y.
Bluffton Mfg. Co., The, Findlay, O.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
Burke Stoker & Mfg. Co., Chicago, Ill.
Burnham Stoker Co., Vancouver, Wash.
Butler Mfg. Co., Kansas City, Mo.
Canton Stoker Corp., Canton, O.
Carnes, Inc., John R., Lima, O.
Christensen Machine Co., Salt Lake City, Utah.
Columbus Metal Products Co., Columbus, O.
Combustion Engineering Co., Inc., New York, N. Y.
Conco-Sampsel Stoker Corp., Mendota, Ill.
Crown Iron Works, Minneapolis, Minn.
Delta Stoker Co., Chicago, Ill.
●Detroit Stoker Co., Detroit, Mich.
Econocol Stoker Div. of Cotta Transmission Corp., Rockford, Ill.
Eddy Stoker Corp., Chicago, Ill.
Fairbanks-Morse & Co., Chicago, Ill.
Firemood Machine Wks., Converse, Ind.
Flynn & Emrich Co., Baltimore, Md.
Frederick Iron & Steel Co., Frederick, Md.
Fuel Savers, Inc., Harrisburg, Pa.
Gehl Bros. Mfg. Co., West Bend, Wis.
General Stokers, Inc., Philadelphia, Pa.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Heating Assurance, Inc., Spokane, Wash.
Her-Born Engrg. & Mfg. Co., Sandusky, O.
Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.
Hoffman Combustion Engineering Co., Detroit, Mich.
Holcomb & Hoke Mfg. Co., Indianapolis, Ind.
Illinois Iron & Bolt Co., Chicago, Ill.
International Engineering Wks., Inc., Framingham, Mass.
Iron Fireman Mfg. Co., Cleveland, O.
Johnston & Jennings Co., Cleveland, O.
Kol-Master Corp., Oregon, Ill.
Laclede Stoker Co., St. Louis, Mo.

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Leffel & Co., Springfield, O.
Link-Belt Co., Chicago, Ill.
Macrae, Inc., Brooklyn, N. Y.
Mallory Sales Co., Dolton, Ill.
Marion Machine Foundry & Supply Co., Marion, Ind.
McClave-Brooks Co., Scranton, Pa.
Muncie Gear Wks., Inc., Muncie, Ind.
National Steam Pump Co., Upper Sandusky, O.
Neemes Foundry, Inc., Troy, N. Y.
Norge Heating & Conditioning Div., Borg-Warner Corp., Detroit, Mich.
Patterson Foundry & Machine Co., East Liverpool, O.
Peabody Engrg. Corp., New York, N. Y.
Perfection Grate & Stoker Co., Springfield, Mass.
Redi Automatic Coal Burners, Inc., Spokane, Wash.
Riley Stoker Corp., Worcester, Mass.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Schwitzer-Cummins Co., Indianapolis, Ind.
Sinker-Davis Co., Indianapolis, Ind.
Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.
Steel Products Engineering Co., Springfield, O.
Stok-A-Fire Co., St. Louis, Mo.
Stokermatic Co., Salt Lake City, Utah.
Taylor Engineering Co., Cincinnati, O.
Wayne Oil Burner Corp., Fort Wayne, Ind.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Whiting Corp., Harvey, Ill.
Will-Burt Co., Orrville, O.

STONEWARE PIPE

See Pipe, Stoneware

STORAGE WATER HEATERS

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STRAINERS, PIPE LINE

●American District Steam Co., North Tonawanda, N. Y.
American Injector Co., Detroit, Mich.
●Anderson Co., V. D., The, Cleveland, O.
Barrett, Haentjens & Co., Hazelton, Pa.
Blackmer Pump Co., Grand Rapids, Mich.
Boylston Steam Specialty Co., Chicago, Ill.
Buffalo Meter Co., Buffalo, N. Y.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Cashin Co., W. D., Boston, Mass.
Central Brass Mfg. Co., Cleveland, O.
●Crane Co., Chicago, Ill.
Cuno Engineering Corp., Meriden, Conn.
Davis Regulator Co., Chicago, Ill.
Direct Separator Co., Inc., Syracuse, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Elliott Co., Jeannette, Pa.
Fisher Governor Co., Marshalltown, Ia.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Foster Engineering Co., Newark, N. J.
●Grinnell Co., Providence, R. I.
Henry Valve Co., Chicago, Ill.
Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kaye & MacDonald, Inc., West Orange, N. J.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, New York, N. Y.
Kraissl Co., Inc., The, Hackensack, N. J.
Leslie Co., Lyndhurst, N. J.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
●Monarch Mfg. Wks., Inc., Philadelphia, Pa.
Mueller Brass Co., Port Huron, Mich.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., New York, N. Y.
Newark Wire Cloth Co., Newark, N. J.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
●Sarco Co., New York, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sheffler-Gross Co., Philadelphia, Pa.
Spence Engineering Co., Walden, N. Y.
Spray Engineering Co., Somerville, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Sterling Engineering Co., Milwaukee, Wis.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
●Trane Co., La Crosse, Wis.
Trimount Rotary Power Co., East Dedham, Mass.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

STRESS RELIEVERS

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STRIP HEATERS

See Heaters, Strip and Immersion, Electric

STRUCTURAL SHAPES

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SUMP PUMPS

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SURFACE, COOLING, BRINE

Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bush Mfg. Co., Hartford, Conn.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fedders Mfg. Co., Inc., Buffalo, N. Y.
Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
●G. & O. Mfg. Co., New Haven, Conn.
General Refrigeration Corp., Beloit, Wis.
Griscom-Russell Co., New York, N. Y.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Lewis & Co., Joseph E., Baltimore, Md.
Manufacturers Fin Coil Co., Chicago, Ill.
Marlo Coil Co., St. Louis, Mo.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Mojonnier Bros. Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.
Niagara Blower Co., New York, N. Y.
Peerless of America, Inc., Chicago, Ill.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
●Refrigeration Economics Co., Inc., Canton, O.
Reliance Refrigerating Machine Co., Chicago, Ill.
●Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Sturtevant Co., B. F., Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Thermal Units Mfg. Co., Div. of Air Devices Corp., Meriden, Conn.
●Trane Co., La Crosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
●Unit Heater & Cooler Co., Wausau, Wis.
●Wing Mfg. Co., L. J., New York, N. Y.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
Yates-American Machine Co., Beloit, Wis.
●Young Radiator Co., Racine, Wis.

SURFACE, COOLING, COLD WATER

Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
American Radiator Co., New York, N. Y.
Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bush Mfg. Co., Hartford, Conn.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fedders Mfg. Co., Inc., Buffalo, N. Y.
Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
●G. & O. Mfg. Co., New Haven, Conn.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
General Refrigeration Corp., Beloit, Wis.
Griscom-Russell Co., New York, N. Y.
Johnson Fan & Blower Corp., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Larkin Coils, Inc., Atlanta, Ga.
Lewis & Co., Joseph E., Baltimore, Md.
Manufacturers Fin Coil Co., Chicago, Ill.
Marlo Coil Co., St. Louis, Mo.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Mojonnier Bros. Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.
Niagara Blower Co., New York, N. Y.
Peerless of America, Inc., Chicago, Ill.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
●Refrigeration Economics Co., Inc., Canton, O.
Reliance Refrigerating Machine Co., Chicago, Ill.
●Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Sturtevant Co., B. F., Boston, Mass.
Star Radiator Co., Los Angeles, Cal.
Super Radiator Corp., Minneapolis, Minn.
Thermal Units Mfg. Co., Div. of Air Devices Corp., Meriden, Conn.
●Trane Co., La Crosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
●Unit Heater & Cooler Co., Wausau, Wis.
●Wing Mfg. Co., L. J., New York, N. Y.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
Yates-American Machine Co., Beloit, Wis.
●Young Radiator Co., Racine, Wis.

SURFACE, COOLING, DIRECT EXPANSION

Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.

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SYSTEMS, COMBUSTION CONTROL

Askania Regulator Co., Chicago, Ill.
Bailey Meter Co., Cleveland, O.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Denver Fire Clay Co., Denver, Colo.
General Electric Co., Schenectady, N. Y.
Hagan Corp., Pittsburgh, Pa.
Hays Corp., Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
National Brass Co., Grand Rapids, Michigan
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Paragon Electric Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Shallcross Controls, Inc., Milwaukee, Wis.

SYSTEMS, HEATING, HOT WATER

American Radiator Co., New York, N. Y.
●Bell & Gossett Co., Chicago, Ill.
General Fittings Co., Providence, R. I.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Kainer & Co., Chicago, Ill.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Stevens-Root Co., Chicago, Ill.
Thrush & Co., H. A., Peru, Ind.
Triplex Mfg. Co., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.

SYSTEMS, HEATING, VACUUM

American Radiator Co., New York, N. Y.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Cashin, W. D., Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
●Sarco Co., Inc., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

SYSTEMS, HEATING, VAPOR

●American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Barnes & Jones, Inc., Boston, Mass.
Gorton Heating Corp., Cranford, N. J.
Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
Sterling Engineering Co., Milwaukee, Wis.
●Webster & Co., Warren, Camden, N. J.

SYSTEMS, HEATING, ZONE CONTROL

American Radiator Co., New York, N. Y.
Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Barnes & Jones, Inc., Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Marsh Tritrol Co., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Raymond Co., F. I., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Spence Engineering Co., Inc., Walden, N. Y.
●Tallmadge & Co., Webster, East Orange, N. J.
Thrush & Co., H. A., Peru, Ind.
●Webster & Co., Warren, Camden, N. J.

SYSTEMS, PROCESS HEATING, HIGH TEMPERATURE

Barnes & Jones, Inc., Boston, Mass.
Dow Chemical Co., Midland, Mich.
●Illinois Engineering Co., Chicago, Ill.
Parks-Cramer Co., Fitchburg, Mass.
Ross Engineering Corp., J. O., New York, N. Y.
Surface Combustion Corp., Toledo, O.
●Webster & Co., Warren, Camden, N. J.

TANKS, PROCESS AND STORAGE

Alco Products, Div. of American Locomotive Co., New York, N. Y.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Bigelow Co., New Haven, Conn.
Biggs Boiler Wks. Co., E. Akron, O.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
Buffalo Tank Co., Arlington, Staten Island, N. Y.
Caldwell Co., W. E., Louisville, Ky.
Case & Son Mfg. Co., W. A., Buffalo, N. Y.
Chicago Bridge & Iron Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Connery Construction Co., Philadelphia, Pa.
Continental Diamond Fibre Co., Newark, Del.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Dahlquist Mfg. Co., Inc., Boston, Mass.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Dillon Steam Boiler Wks., Inc., D. M., Fitchburg, Mass.
Downingtown Iron Wks., Downingtown, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Falstrom Co., Passaic, N. J.
Farquhar Co., Ltd., A. B., York, Pa.
Farrar & Trefts, Buffalo, N. Y.
Gerstein & Cooper Co., South Boston, Mass.
Goodrich Co., B. F., Akron, O.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Graver Tank & Mfg. Co., Inc., East Chicago, Ind.
Hamburg Boiler Wks., Inc., Hamburg, Pa.
Harris & Co., Arthur, Chicago, Ill.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Framingham, Mass.
●Kewanee Boiler Corp., Kewanee, Ill.
Kirk & Blum Mfg. Co., Cincinnati, O.
Kisco Co., Inc., St. Louis, Mo.
Koven & Bro., L. O., Jersey City, N. J.
La Crosse Tractor Co., La Crosse, Wis.
Lapp Insulator Co., Inc., Le Roy, N. Y.
Littleford Bros., Cincinnati, O.
Lead Lined Iron Pipe Co., Wakefield, Mass.
Manitowoc Boiler Wks., Manitowoc, Wis.
Mauck Seamless Copper Tank Co., Victor, Norristown, Pa.
Maxweld Corp., Brooklyn, N. Y.
Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
Murray Iron Wks. Co., Burlington, Ia.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Quaker City Iron Wks., Philadelphia, Pa.
Richmond Engineering Co., Richmond, Va.
Riverside Boiler Wks., Inc., Cambridge, Mass.
Roessing Mfg. Co., Pittsburgh, Pa.
Scaife & Sons Co., Wm. B., Oakmont, Pa.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Titusville Iron Wks. Co., Titusville, Pa.
Trageser Steam Copper Wks., John, Maspeth, Long Island, N. Y.
Uniflow Mfg. Co., Erie, Pa.
United States Rubber Co., New York, N. Y.
Walsh-Holyoke Steam Boiler Co., Holyoke, Mass.
Wheeling Steel Corp., Wheeling, W. Va. (Heater)
Whitehead Metal Products Co. of New York, Inc., New York, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

TEMPERATURE RECORDERS

See Recorders, Temperature

TEMPERATURE REGULATORS

See Regulators, Temperature

THERMOMETERS, INDICATING, INDUSTRIAL

American Thermometer Co., St. Louis, Mo.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Crew-Equipment Co., Inc., New York, N. Y.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
Ideal Commutator Dresser Co., Sycamore, Ill.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Martocello & Co., Jos. A., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Philadelphia Thermometer Co., Philadelphia, Pa.
●Powers Regulator Co., Chicago, Ill.
Pyrometer Instrument Co., New York, N. Y.
Scientific Instrument Co., Detroit, Mich.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 168.

Bush Mfg. Co., Hartford, Conn.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fedders Mfg. Co., Inc., Buffalo, N. Y.
●G. & O. Mfg. Co., New Haven, Conn.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
General Refrigeration Corp., Beloit, Wis.
Hardy Mfg. Co., Inc., Dayton, O.
Ilg Electric Ventilating Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Larkin Coils, Inc., Atlanta, Ga.
Lewis & Co., Joseph E., Baltimore, Md.
Manufacturers Fin Coil Co., Chicago, Ill.
Marlo Coil Co., St. Louis, Mo.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Mojonnier Bros. Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.
Niagara Blower Co., New York, N. Y.
Peerless of America, Inc., Chicago, Ill.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
●Refrigeration Economics Co., Inc., Canton, O.
Reliance Refrigerating Machine Co., Chicago, Ill.
●Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Sturtevant Co., B. F., Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Thermal Units Mfg. Co., Div. of Air Devices Corp., Meriden, Conn.
●Trane Co., La Crosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
●Unit Heater & Cooler Co., Wausau, Wis.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
Yates-American Machine Co., Beloit, Wis.
●Young Radiator Co., Racine, Wis.

SURFACE, HEATING, FERROUS

●Airtherm Mfg. Co., St. Louis, Mo.
American Radiator Co., New York, N. Y.
Bayley Blower Co., Milwaukee, Wis.
●Burnham Boiler Co., Irvington, N. Y.
Griscom-Russell Co., New York, N. Y.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
●Refrigeration Economics Co., Inc., Canton, O.
●Shaw-Perkins Co., Pittsburgh, Pa.
●Unit Heater & Cooler Co., Wausau, Wis.
Wolff & Munier, Inc., New York, N. Y. (For panel heating)

SURFACE, HEATING, NON-FERROUS

●Aerofin Corp., Syracuse, N. Y.
American Radiator Co., New York, N. Y.
Bayley Blower Co., Milwaukee, Wis.
Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bush Mfg. Co., Hartford, Conn.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fedders Mfg. Co., Inc., Buffalo, N. Y.
●G. & O. Mfg. Co., New Haven, Conn.
General Electric Co., Air Conditioning Dept., Bloomfield, N J.
Griscom-Russell Co., New York, N. Y.
Johnson Fan & Blower Corp., Chicago, Ill.
Manufacturers Fin Coil Co., Chicago, Ill.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine, Mfg. Co., Racine, Wis.
●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
Niagara Blower Co., New York, N. Y.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
●Refrigeration Economics Co., Inc., Canton, O.
●Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Star Radiator Co., Los Angeles, Cal.
Sturtevant Co., B. F., Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Thermal Units Mfg. Co., Div. of Air Devices Corp., Meriden, Conn.
●Trane Co., La Crosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
●Unit Heater & Cooler Co., Wausau, Wis.
Winchester Repeating Arms Co., New Haven, Conn.
●Wing Mfg. Co., L. J., New York, N. Y.
●Young Radiator Co., Racine, Wis.

SURFACE THERMOSTATS

See Thermostats, Surface

SWITCHES, ELECTRICAL

Adam Electric Co., Frank, St. Louis, Mo.
Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Elect. Co., Hartford, Conn.
Automatic Switch Co., New York, N. Y.
Clark Controller Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
Delta-Star Electric Co., Chicago, Ill.
Dunn, Inc., Struthers, Philadelphia, Pa.
Electric Controller & Mfg. Co., Cleveland, O.
General Controls Co., Glendale, Cal.
General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
Micro Switch Corp., Freeport, Ill.
Monitor Controller Co., Baltimore, Md.
Penn Electric Switch Co., Goshen, Ind.
Square D Co., Detroit, Mich.
Tork Clock Co., Inc., Mount Vernon, N. Y.
Trumbull Electric Mfg. Co., Plainville, Conn.
Ward Leonard Electric Co., Mount Vernon, N. Y.
Webster Electric Co., Racine, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.

SWITCHES, FLOAT, REFRIGERATION

●Alco Valve Co., Inc., St. Louis, Mo.
Clark Controller Co., Cleveland, O.
●Frick Co., Waynesboro, Pa.
McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.

SWITCHES, LIQUID LEVEL

Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Elect. Co., Hartford, Conn.
Bender Warrick Corp., Birmingham, Mich.
Cissell Mfg. Co., W. M., Louisville, Ky.
Clark Controller Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
●Frick Co., Waynesboro, Pa.
General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn.
Healy Ruff Co., St. Paul, Minn.
Kisco Co., Inc., St. Louis, Mo.
McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Paragon Electric Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Square D Co., Detroit, Mich.
Trumbull Electric Mfg. Co., Plainville, Conn.

SWITCHES, MERCURY

Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Durakool, Inc., Elkhart, Ind.
Jefferson Electric Co., Bellwood, Ill.
Mercoid Corp., Chicago, Ill.

SWITCHES, PRESSURE AND VACUUM

Allen-Bradley Co., Milwaukee, Wis.
Au-Temp-Co Corp., New York, N. Y.
Boston Auto Gage Co., Pittsfield, Mass.
Clark Controller Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
Marsh Corp., Jas. P., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Monitor Controller Co., Baltimore, Md.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Detroit, Mich.
Uniflow Mfg. Co., Erie, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●White-Rodgers Electric Co., St. Louis, Mo.

SWITCHES, TIME

Au-Temp-Co Corp., New York, N. Y.
●Detroit Lubricator Co., Detroit, Mich.
Edison, Inc., Thomas A., Edison Electrical Controls Div., West Orange, N. J.
Electro Hot Heater Co., Tacoma, Wash.
General Controls Co., Glendale, Cal.
General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
Marsh Corp., Jas. P., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Paragon Electric Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Rhodes, Inc., M. H., Hartford, Conn.
Sangamo Electric Co., Springfield, Ill.
Spencer Thermostat Co., Attleboro, Mass.
●Tallmadge & Co., Webster, East Orange, N. J.
Tork Clock Co., Inc., Mount Vernon, N. Y.
Wheelco Instruments Co., Chicago, Ill.

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●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
United States Gauge Co., New York, N. Y.
Weston Electrical Instrument Corp., Newark, N. J.

THERMOMETERS, INDICATING, REMOTE-READING

Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div, La Crosse, Wis.
Engelhard, Inc., Charles, Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
H-B Instrument Co., Philadelphia, Pa.
Hays Corp., Michigan City, Ind.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
●Powers Regulator Co., Chicago, Ill.
Pyrometer Instrument Co., New York, N. Y.
●Sarco Co., Inc., New York, N. Y.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
United States Gauge Co., New York, N. Y.
Wheelco Instruments Co., Chicago, Ill.

THERMOMETERS, INDICATING, WALL

American Thermometer Co., St. Louis, Mo.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Engelhard Inc., Charles, Newark, N. J.
Fee and Stemwedel, Inc., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hill, E. Vernon, Chicago, Ill.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Marsh Corp., Jas P., Chicago, Ill.
Martocello & Co., Jos. A., Philadelphia, Pa.
Moeller Instrument Co., Richmond Hill, N. Y.
Parsons, John R., New York, N. Y. (Effective temperature indicator)
Philadelphia Thermometer Co., Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
United States Gauge Co., New York, N. Y.
Weston Electrical Instrument Corp., Newark, N. J.
Wheelco Instruments Co., Chicago, Ill.

THERMOMETERS, KATA

G. M. Mfg. Co., New York, N. Y.

THERMOMETERS, RECORDING

Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Engelhard Inc., Charles, Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
H-B Instrument Co., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
●Powers Regulator Co., Chicago, Ill.
●Practical Instrument Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.

THERMOSTATIC BELLOWS

See Bellows, Thermostatic

THERMOSTATIC BI-METALS

See Bi-Metals, Thermostatic

THERMOSTATIC TRAPS

See Traps, Steam, Thermostatic

THERMOSTATS, DUCT TYPE

Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Burling Instrument Co., Newark, N. J.
Cook Electric Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Edison, Inc., Thomas A., Edison Electric Controls Div., West Orange, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
Hart Mfg. Co., Hartford, Conn.
Hill, E. Vernon, Chicago, Ill.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Philadelphia Thermometer Co., Philadelphia, Pa.
●Powers Regulator Co., Chicago, Ill.
●Sarco Co., New York, N. Y.
Sheer Co., H. M., Quincy, Ill.
Spencer Thermostat Co., Attleboro, Mass.
Standard Thermometer, Inc., Boston, Mass.
Superstat Co., Springfield, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Tallmadge & Co., Webster, East Orange, N. J.
●Taylor Instrument Companies, Rochester, N. Y.
United Electric Controls Co., Boston, Mass.
●White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, EFFECTIVE TEMPERATURE

Barber-Colman Co., Rockford, Ill.
●Johnson Service Co., Milwaukee, Wis.
Friez & Sons, Julien P., Baltimore, Md.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
United Electric Controls Co., Boston, Mass.

THERMOSTATS, IMMERSION

Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burling Instrument Co., Newark, N. J.
d'Este Co., Julian, Charlestown, Mass.
●Detroit Lubricator Co., Detroit, Mich.
Dunn, Inc., Struthers, Philadelphia, Pa.
Edison, Inc., Thomas A., Edison Electric Controls Div., West Orange, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
H-B Instrument Co., Philadelphia, Pa.
Hart Mfg. Co., Hartford, Conn.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
Leslie Co., Lyndhurst, N. J.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
●Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Superstat Co., Springfield, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
United Electric Controls Co., Boston, Mass.
●White-Rodgers Electric Co., St. Louis, Mo.
Wilcolator Co., Newark, N. J.

THERMOSTATS, REMOTE CONTROL

Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
d'Este Co., Julian, Charlestown, Mass.
●Detroit Lubricator Co., Detroit, Mich.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
General Controls Co., Glendale, Cal.
Hart Mfg. Co., Hartford, Conn.
●Illinois Engineering Co., Chicago, Ill.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.

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Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
●Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
United Electric Controls Co., Boston, Mass.
●White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, ROOM OR WALL

Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Barber-Colman Co., Rockford, Ill.
●Bell & Gossett Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Cook Electric Co., Chicago, Ill.
Crise Elec. Mfg. Co., Mt. Vernon, O.
●Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Baltimore, Md.
●Fulton Sylphon Co., Knoxville, Tenn.
General Controls Co., Glendale, Cal.
Gleason-Avery, Inc., Auburn, N. Y.
●Illinois Engineering Co., Chicago, Ill.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
Master Electric Co., Dayton, O.
McAlear Mfg. Co., Chicago, Ill.
McCorkle Co., D. H., Berkeley, Calif.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
●Powers Regulator Co., Chicago, Ill.
Rega Mfg. Co., Rochester, N. Y.
Russell Electric Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Sheer Co., H. M., Quincy, Ill.
Spencer Thermostat Co., Attleboro, Mass.
Standard Thermometer, Inc., Boston, Mass.
Superstat Co., Springfield, Mass.
●Tallmadge & Co., Webster, East Orange, N. J.
●Taylor Instrument Companies, Rochester, N. Y.
United Electric Controls Co., Boston, Mass.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, SURFACE

Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
●Detroit Lubricator Co., Detroit, Mich.
Dunn, Inc., Struthers, Philadelphia, Pa.
Edison, Inc., Thomas A., Edison Electric Controls Div., West Orange, N. J.
Foxboro Co., Foxboro, Mass.
Hart Mfg. Co., Hartford, Conn.
Jefferson Electric Co., Bellwood, Ill.
McCorkle Co., D. H., Berkeley, Cal.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
●Powers Regulator Co., Chicago, Ill.
Ranco, Inc., Columbus, O.
●Sarco Co., Inc., New York, N. Y.
Sheer Co., H. M., Quincy, Ill.
Spencer Thermostat Co., Attleboro, Mass.
Superstat Co., Springfield, Mass.
●Taylor Instrument Companies, Rochester, N. Y.
United Electric Controls Co., Boston, Mass.
●White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, TWO TEMPERATURE OR DUAL

Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Burling Instrument Co., Newark, N. J.
●Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Baltimore, Md.
General Controls Co., Glendale, Cal.
Gleason-Avery, Inc., Auburn, N. Y.
H-B Instrument Co., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
McAlear Mfg. Co., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
●Powers Regulator Co., Chicago, Ill.
Ranco, Inc., Columbus, O.
●Sarco Co., Inc., New York, N. Y.
Sheer Co., H. M., Quincy, Ill.
Superstat Co., Springfield, Mass.
●Taylor Instrument Companies, Rochester, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●White-Rodgers Electric Co., St. Louis, Mo.
United Electric Controls Co., Boston, Mass.

THERMOSTATS, WEATHER COMPENSATING

Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
United Electric Controls Co., Boston, Mass.

TIME SWITCHES

See Switches, Time

TOGGLE BOLTS

See Bolts, Toggle and Anchor

TONGS, PIPE

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Jarecki Mfg. Co., Erie, Pa.
Trimont Mfg. Co., Boston, Mass.
●Williams & Co., J. H., New York, N. Y.

TORCHES, BRAZING

Air Reduction Sales Co., New York, N. Y.
Bastian-Blessing Co., Chicago, Ill.
Bernz Co., Inc., Otto, Rochester, N. Y.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Dockson Co., C. H., Detroit, Mich.
Eclipse Fuel Engineering Co., Rockford, Ill.
Gasweld Equipment Co., Chicago, Ill.
Ideal Commutator Dresser Co., Sycamore, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Insto-Gas Corp., Detroit, Mich.
●Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Milburn Co., Alexander, Baltimore, Md.
Torchweld Equipment Co., Chicago, Ill.
Turner Brass Wks., Sycamore, Ill.

TORQUE INDICATING WRENCHES

See Wrenches, Torque Indicating

TOWERS, COOLING, ATMOSPHERIC

American Cooling Tower Co., Kansas City, Mo.
Binks Mfg. Co., Chicago, Ill.
Burhorn Co., Edwin, Hoboken, N. J.
Cooling Tower Co., Inc., The, Div. of The Fluor Corp., Ltd., New York, N. Y.
Fluor Corp., Ltd., The, Los Angeles, Cal.
Foster Wheeler Corp., New York, N. Y.
Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
Marley Co., Kansas City, Mo.
Penn Cooling Tower Wks., Pittsburgh, Pa.
Pennsylvania Engineering Wks., New Castle, Pa.
Schubert-Christy Corp., Affton, St. Louis, Mo.
Star Radiator Co., Los Angeles, Cal.
Stewart Ice Machine Co., Los Angeles, Cal.
Tippett & Wood, Phillipsburg, N. J.
Water Cooling Tower Co., Chicago, Ill.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.

TOWERS, COOLING, MECHANICAL DRAFT

Binks Mfg. Co., Chicago, Ill.
Burhorn Co., Edwin, Hoboken, N. J.
Cooling Tower Co., Inc., The, Div. of The Fluor Corp., Ltd., New York, N. Y.
Fluor Corp., Ltd., The, Los Angeles, Cal.
Foster Wheeler Corp., New York, N. Y.
Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
Marley Co., Kansas City, Mo.
Motor Equipment Co., Wichita, Kans.
Penn Cooling Tower Wks., Pittsburgh, Pa.
Pennsylvania Engineering Wks., New Castle, Pa.
Research Corp., New York, N. Y.
Schubert-Christy Corp., Affton, St. Louis, Mo.
Water Cooling Tower Co., Chicago, Ill.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.

TRANSMISSION DRIVES

See Drives, Chain, Flat Belt and V-Belt

● Advertisement in this issue. See Index to Advertisers, page 168.

TRAPS, STEAM, MECHANICAL
●American District Steam Co., North Tonawanda, N. Y.
●Anderson Co., V. D., The, Cleveland, O.
●Armstrong Machine Wks., Three Rivers, Mich.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Bishop & Babcock Mfg. Co., Cleveland, O.
Boylston Steam Specialty Co., Chicago, Ill.
Bundy Steam Trap Co., Nashua, N. H.
Burrows Mfg. Co., F. A., York, Pa.
Cash Universal Regulator Co., Marshalltown, Ia.
Cashin Co., W. D., Boston, Mass.
●Cochran Corp., Philadelphia, Pa.
Coe Mfg. Co., Painesville, O.
●Crane Co., Chicago, Ill.
Cryer Trap & Valve Co., Inc., New York, N. Y.
Davis Regulator Co., Chicago, Ill.
d'Este Co., Julian, Charlestown, Mass.
Ellis Drier Co., Chicago, Ill.
Fisher Governor Co., Marshalltown, Ia.
Haines & Co., William S., Philadelphia, Pa.
Healy Ruff Co., St. Paul, Minn.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
Justus Steam Trap Co., Napanoch, N. Y.
Kaye & MacDonald, Inc., West Orange, N. J.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Lytton Mfg. Co., Franklin, Va.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
McAuley Automatic Trap Co., Pittsburgh, Pa.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Morehead Mfg. Co., Detroit, Mich.
Mouat Vapor Heating Co., The, Cleveland, O.
Mueller Steam Specialty Co., Inc., New York, N. Y.
Nason Co., Detroit, Mich.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
●Sarco Co., Inc., New York, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Squires Co., C. E., Cleveland, O.
Star Radiator Co., Los Angeles, Cal.
Sterling Engineering Co., Milwaukee, Wis.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Trerice Co., H. O., Detroit, Mich.
Watson & McDaniel Co., Philadelphia, Pa.
●Webster & Co., Warren, Camden, N. J.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.

TRAPS, STEAM, THERMOSTATIC
●American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Bishop & Babcock Mfg. Co., Cleveland, O.
Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
Cashin Co., W. D., Boston, Mass.
●Clifford Mfg. Co., Boston, Mass.
Cryer Trap & Valve Co., Inc., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
Haines & Co., William S., Philadelphia, Pa.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
International Nutyp Tool Corp., Oswego, N. Y.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
●Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Trane Co., La Crosse, Wis.
Trerice Co., H. O., Detroit, Mich.
●Webster & Co., Warren, Camden, N. J.

TUBE CLEANERS
See Cleaners, Tube

TUBES, BOILER
Bethlehem Steel Co., Bethlehem, Pa.
Bigelow Co., New Haven, Conn.
Globe Steel Tubes Co., Milwaukee, Wis.
International Engineering Wks., Inc., Framingham, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keeney Mfg. Co., Newington, Conn.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
●Republic Steel Corp., Cleveland, O.
Steel & Tubes, Inc., Cleveland, O.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Timken Steel & Tube Co., Canton, O.
United States Steel Corp., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

TUBES, PITOT
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Detroit Air Meter Co., Detroit, Mich.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
Hill, E. Vernon, Chicago, Ill.

TUBING, ALLOY
Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Aluminum Co. of America, Pittsburgh, Pa. (Aluminum)
●American Brass Co., Waterbury, Conn.
Babcock & Wilcox Co., New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn. (Bronze and silicon bronze)
Carpenter Steel Co., Reading, Pa. (Stainless steel)
Chase Brass & Copper Co., Waterbury, Conn.
Colonial Alloys Co., Specialties Div., Philadelphia, Pa.
Duraloy Co., Pittsburgh, Pa. (Stainless)
Globe Steel Tubes Co., Milwaukee, Wis.
International Nickel Co., New York, N. Y. (Monel)
National Tube Co., Pittsburgh, Pa. (Stainless)
Parker Appliance Co., Cleveland, O.
Phelps Dodge Copper Products Corp., British American Tube Div., New York, N. Y.
●Republic Steel Corp., Cleveland, O.
●Revere Copper & Brass, Inc., New York, N. Y. (Brass, bronze, Herculoy)
Scovill Mfg. Co., Waterbury, Conn. (Silicon bronze)
Steel and Tubes, Inc., Cleveland, O. (Stainless steel)
Timken Steel & Tube Co., Canton, O. (Steel)
United States Steel Corp., Pittsburgh, Pa.
Wolverine Tube Co., Detroit, Mich. (Brass, Admiralty)

TUBING BENDERS
See Benders, Tubing

TUBING, COPPER
●American Brass Co., Waterbury, Conn.
American Radiator Co., New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Hussey & Co., C. G., Pittsburgh, Pa.
Mueller Brass Co., Port Huron, Mich.
Parker Appliance Co., Cleveland, O.
Phelps Dodge Copper Products Corp., British American Tube Div., New York, N. Y.
●Revere Copper & Brass, Inc., New York, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
United States Brass & Copper Co., Hyde Park, Boston, Mass.
Wolverine Tube Co., Detroit, Mich.

TUBING, CUTTERS
See Cutters, Tubing

TUBING, FINNED
●Aerofin Corp., Syracuse, N. Y.
●Airtherm Mfg. Co., St. Louis, Mo.
Akwa Heaters, Inc., New York, N. Y.
Bush Mfg. Co., Hartford, Conn.
●G. & O. Mfg. Co., New Haven, Conn.
Manufacturers Fin Coil Co., Chicago, Ill.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Refrigeration Appliances, Inc., Chicago, Ill.
●Refrigeration Economics Co., Inc., Canton, O.
●Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
●Trenton Auto Radiator Wks., Trenton, N. J.
Wolverine Tube Co., Detroit, Mich. (Aluminum, copper)

TUBING, STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co., New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bundy Tubing Co., Detroit, Mich.
Detroit Seamless Steel Tubes Co., Detroit, Mich.
Globe Steel Tubes Co., Milwaukee, Wis.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
●Republic Steel Corp., Cleveland, O.
South Chester Tube Co., Chester, Pa.
Spang Chalfant, Inc., Pittsburgh, Pa.
Steel and Tubes, Inc., Cleveland, O.
Timken Steel & Tube Co., Canton, O.
United States Steel Corp., Pittsburgh, Pa.
Wheatland Tube Co., Philadelphia, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

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TURBINES, MECHANICAL DRIVE

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Carling Blower Co., Worcester, Mass.
Coppus Engineering Corp., Worcester, Mass.
Dean Hill Pump Co., Anderson, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Elliott Co., Jeannette, Pa.
General Electric Co., Schenectady, N. Y.
Moore Steam Turbine Corp., Wellsville, N. Y.
Murray Iron Wks. Co., Burlington, Ia.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Terry Steam Turbine Co., Hartford, Conn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Wing Mfg. Co., L. J., New York, N. Y.

2, 3 AND 4-WAY VALVES

See Valves, 2, 3 and 4-way

UNDERGROUND PIPE DETECTORS

See Detectors, Underground Pipe

UNDERGROUND PIPING

See Conduit, Underground Piping

UNIONS, BRASS

Belknap Mfg. Co., Bridgeport, Conn.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co., Providence, R. I.
Grabler Mfg. Co., Cleveland, O.
Hays Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Mfg. Co., New York, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
Lockport Fittings Co., Inc., Lockport, N. Y.
Lunkenheimer Co., Cincinnati, O.
Milwaukee Valve Co., Milwaukee, Wis.
Mueller Brass Co., Port Huron, Mich.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Standard Union Co., Lockport, N. Y.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburg, Pa.
Weatherhead Co., Cleveland, O.
Williams Valve Co., D. T., Cincinnati, O.

UNIONS, MALLEABLE, BRASS SEAT

Corley Co., Jersey City, N. J.
●Crane Co., Chicago, Ill.
●Dart Mfg. Co., E. M., Providence, R. I.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
●Fairbanks Co., New York, N. Y.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co., Providence, R. I.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jefferson Union Co., Lexington, Mass.
Kennedy Valve Mfg. Co., Elmira, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
Lockport Fittings Co., Inc., Lockport, N. Y.
Malleable Iron Fittings Co., Branford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Rockwood Sprinkler Co., Worcester, Mass.
Standard Union Co., Lockport, N. Y.
Star Mfg. Co., Inc., Providence, R. I.
Stockham Pipe Fittings Co., Birmingham, Ala.
United Superior Union Co., Inc., Brooklyn, N. Y.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburg, Pa.

UNIONS, STEEL

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Central Forging Co., Catawissa, Pa.
Champion Machine & Forging Co., Cleveland, O.
●Crane Co., Chicago, Ill.
Henry Valve Co., Chicago, Ill.
Parker Appliance Co., Cleveland, O.
Rockwood Sprinkler Co., Worcester, Mass.
Roessing Mfg. Co., Pittsburgh, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

UNIT COOLERS

See Coolers, Unit

UNITS, AIR CONDITIONING, COMFORT, SUMMER (CENTRAL PLANT TYPE)

Air & Refrigeration Corp., New York, N. Y.
●Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.
American Car & Foundry Co., New York, N. Y. (For railroad cars only)
●Baker Ice Machine Co., Inc., Omaha, Neb.
Ballantyne Co., Omaha, Neb.
Betz Air Conditioning Corp., Kansas City, Mo.
●Buffalo Forge Co., Buffalo, N. Y.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
General Refrigeration Corp., Beloit, Wis.
Governair Corp., Oklahoma City, Okla.
Hastings Air Conditioning Co., Hastings, Neb.
Howe Ice Machine Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
King Ventilating Co., Owatonna, Minn.
Larkin Coils, Inc., Atlanta, Ga.
Mayflower-Lewis Corp., St. Paul, Minn.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, Moline, Ill.
Niagara Blower Co., New York, N. Y.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
●Refrigeration Economics Co., Inc., Canton, O.
●Rempe Co., Chicago, Ill.
Research Corp., New York, N. Y.
Richmond Engineering Co., Richmond, Va.
Simmons Co., Gordon H., Milwaukee, Wis.
Standard Air Conditioning, Inc., New York, N. Y.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
●Trane Co., La Crosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, COMFORT, SUMMER (ROOM COOLERS)

Airgard Mfg. Co., Chicago, Ill.
Air Devices Corp., Meriden, Conn.
●Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.
Ballantyne Co., Omaha, Neb.
●Carrier Corp., Syracuse, N. Y.
Coolmaster Corp., Chicago, Ill. (Evaporative cooling principle, no dehumidifying)
Crystal Refrigerator Co., Fremont, Neb.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
●Dunham Co., C. A., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill. (Evaporative type)
Fairbanks, Morse & Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
General Refrigeration Corp., Beloit, Wis.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Governair Corp., Oklahoma City, Okla.
●Grinnell Co., Inc., Providence, R. I.
Harvey-Whipple, Inc., Springfield, Mass.
Hastings Air Conditioning Co., Hastings, Neb.
Ilg Electric Ventilating Co., Chicago, Ill.
Indian Trailer Corp., Koolroom Div., Chicago, Ill.
Industrial Air Conditioning Co., Inc., Minneapolis, Minn.
Johnson Fan & Blower Corp., Chicago, Ill.
Johnson Motors, Galesburg, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
King Ventilating Co., Owatonna, Minn.
Larkin Coils, Inc., Atlanta, Ga.
Mayflower-Lewis Corp., St. Paul, Minn.
Modine Mfg. Co., Racine, Wis.
●McQuay, Inc., Minneapolis, Minn.
Nelson Corp., Herman, Moline, Ill.
Niagara Blower Co., New York, N. Y.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Norwin Co., Freeport, Ill.
Philco Radio & Television Corp., Philadelphia, Pa.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
●Rempe Co., Chicago, Ill.
Standard Air Conditioning, Inc., New York, N. Y.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.

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●Trane Co., La Crosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

UNITS, AIR CONDITIONING, COMFORT, SUMMER (STORE COOLERS)

●Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Ballantyne Co., Omaha, Neb.
●Buffalo Forge Co., Buffalo, N. Y.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Coolmaster Corp., Chicago, Ill. (Evaporative cooling principle, no dehumidifying)
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Drayer & Hanson, Inc., Los Angeles, Cal.
Economy Electric Mfg. Co., Chicago, Ill. (Evaporative type)
Fairbanks, Morsé & Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
General Refrigeration Corp., Beloit, Wis.
Governair Corp., Oklahoma City, Okla.
●Grinnell Co., Inc., Providence, R. I.
Hastings Air Conditioning Co., Hastings, Neb.
Howe Ice Machine Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
King Ventilating Co., Owatonna, Minn.
Larkin Coils, Inc., Atlanta, Ga.
Mayflower-Lewis Corp., St. Paul, Minn.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Mountain States Equipment Co., Denver, Colo. (Evaporative)
Nelson Corp., Herman, Moline, Ill.
Niagara Blower Co., New York, N. Y.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
●Rempe Co., Chicago, Ill.
Standard Air Conditioning, Inc., New York, N. Y.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
●Trane Co., La Crosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

UNITS, AIR CONDITIONING, COMFORT, WINTER (CENTRAL PLANT TYPE)

Air & Refrigeration Corp., New York, N. Y.
●Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.
American Gas Products, Div. of American Radiator Co., New York, N. Y.
American Radiator Co., New York, N. Y.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Betz Air Conditioning Corp., Kansas City, Mo.
Bryant Heater Co., The, Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
Delco-Frigidaire Conditioning Div, General Motors Sales Corp., Dayton, O.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Frick Co., Waynesboro, Pa.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Howe Ice Machine Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Joliet Heating Corp., Joliet, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
King Ventilating Co., Owatonna, Minn.
Koven & Bro., L. O., Jersey City, N. J.
Lennox Furnace Co., Marshalltown, Ia.
Mayflower-Lewis Corp., St. Paul, Minn.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, Moline, Ill.
Niagara Blower Co., New York, N. Y.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Parks-Cramer Co., Fitchburg, Mass.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
Reif-Rexoil, Inc., Buffalo, N. Y.
Research Corp., New York, N. Y.
Reznor Mfg. Co., Mercer, Pa.
Richmond Engineering Co., Richmond, Va.
●St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Schwitzer-Cummins Co., Indianapolis, Ind.
Simmons Co., Gordon H., Milwaukee, Wis.
Standard Air Conditioning, Inc., New York, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●Trane Co., La Crosse, Wis.
●Trenton Auto Radiator Works, Trenton, N. J.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, COMFORT, WINTER (ROOM TYPE)

●Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.
●Burnham Boiler Corp., Irvington, N. Y.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Dunham Co., C. A., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
●Grinnel Co., Inc., Providence, R. I.
Ilg Electric Ventilating Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Mayflower-Lewis Corp., St. Paul, Minn.
McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, Moline, Ill.
Niagara Blower Co., New York, N. Y.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Norwin Co., Freeport, Ill.
Parks-Cramer Co., Fitchburg, Mass.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
Reznor Mfg. Co., Mercer, Pa.
Richmond Engineering Co., Richmond, Va.
●Somers, Inc., H. J., Detroit, Mich.
Standard Air Conditioning, Inc., New York, N. Y.
●Trane Co., LaCrosse, Wis.
●Trenton Auto Radiator Works, Trenton, N. J.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
●York Ice Machinery Corp., York, Pa.

UNITS, AIR CONDITIONING, COMFORT, YEAR-ROUND (CENTRAL PLANT TYPE)

Air & Refrigeration Corp., New York, N. Y.
●Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.
American Car & Foundry Co., New York, N. Y. (For railroad cars only)
●Baker Ice Machine Co., Inc., Omaha, Neb.
Betz Air Conditioning Corp., Kansas City, Mo.
●Buffalo Forge Co., Buffalo, N. Y.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fairbanks Morse & Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
Howe Ice Machine Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
King Ventilating Co., Owatonna, Minn.
Mayflower-Lewis Corp., St. Paul, Minn.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, Moline, Ill.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Niagara Blower Co., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
●Refrigeration Economics Co., Inc., Canton, O.
●Rempe Co., Chicago, Ill.
Richmond Engineering Co., Richmond, Va.
Simmons Co., Gordon H., Milwaukee, Wis.
Standard Air Conditioning, Inc., New York, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●Trane Co., LaCrosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
United States Radiator Corp., Detroit, Mich.
Viking Air Conditioning Corp., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, COMFORT, YEAR-ROUND (ROOM TYPE)

●Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
●Curtis Refrigerating Machine Co., St. Louis, Mo.

● Advertisement in this issue. See Index to Advertisers, page 168.

Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
●Dunham Co., C. A., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
General Refrigeration Corp., Beloit, Wis.
Howe Ice Machine Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Mayflower-Lewis Corp., St. Paul, Minn.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, Moline, Ill.
Niagara Blower Co., New York, N. Y.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Parks-Cramer Co., Fitchburg, Mass.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
Richmond Engineering Co., Richmond, Va.
Standard Air Conditioning, Inc., New York, N. Y.
●Trane Co., LaCrosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
United States Radiator Corp., Detroit, Mich.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

UNITS, AIR CONDITIONING, INDUSTRIAL PROCESSING, COMPLETE, SPRAY TYPE

American Blower Corp., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Betz Air Conditioning Corp., Kansas City, Mo.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Falstrom Co., Passaic, N. J.
King Ventilating Co., Owatonna, Minn.
●McQuay, Inc., Minneapolis, Minn.
Niagara Blower Co., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Research Corp., New York, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
Standard Air Conditioning, Inc., New York, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●Trane Co., LaCrosse, Wis.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

UNITS, AIR CONDITIONING, INDUSTRIAL PROCESSING, COMPLETE, SURFACE COOLING

●Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
●Buffalo Forge Co., Buffalo, N. Y.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, O.
Drayer & Hanson, Inc., Los Angeles, Cal.
Falstrom Co., Passaic, N. J.
●Frick Co., Waynesboro, Pa.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
General Refrigeration Corp., Beloit, Wis.
Governair Corp., Oklahoma City, Okla.
Howe Ice Machine Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
Niagara Blower Co., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
●Refrigeration Economics Co., Inc., Canton, O.
●Rempe Co., Chicago, Ill.
Ross Engineering Corp., J. O., New York, N. Y.
Simmons Co., Gordon H., Milwaukee, Wis.
Standard Air Conditioning, Inc., New York, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●Trane Co., LaCrosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, INDUSTRIAL PROCESSING, COOLING AND DEHUMIDIFYING, SPRAY TYPE

Air & Refrigeration Corp., New York, N. Y.
American Blower Corp., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Betz Air Conditioning Corp., Kansas City, Mo.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Falstrom Co., Passaic, N. J.
Howe Ice Machine Co., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
●McQuay, Inc., Minneapolis, Minn.
Niagara Blower Co., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Research Corp., New York, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
●St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●Trane Co., LaCrosse, Wis.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.

UNITS, AIR CONDITIONING, INDUSTRIAL PROCESSING, COOLING AND DEHUMIDIFYING, SURFACE COOLING

●Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Davis Engineering Corp., Elizabeth, N. J.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Frick Co., Waynesboro, Pa.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
General Refrigeration Corp., Beloit, Wis.
Giant Mfg. Co., Council Bluffs, Ia.
Governair Corp., Oklahoma City, Okla.
Ilg Electric Ventilating Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
Niagara Blower Co., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Pfening Co., Fred D., Columbus, O.
●Refrigeration Economics Co., Inc., Canton, O.
●Rempe Co., Chicago, Ill.
Research Corp., New York, N. Y.
Richmond Engineering Co., Richmond, Va.
Ross Engineering Corp., J. O., New York, N. Y.
Simmons Co., Gordon H., Milwaukee, Wis.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●Trane Co., LaCrosse, Wis.
●Trenton Auto Radiator Wks., Trenton, N. J.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, INDUSTRIAL PROCESSING, HEATING AND HUMIDIFYING

Air & Refrigeration Corp., New York, N. Y.
American Blower Corp., Detroit, Mich.
Anetsberger Bros., Chicago, Ill.
Bahnson Co., Winston-Salem, N. C.
Betz Air Conditioning Corp., Kansas City, Mo.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
Corozone Air Conditioning Corp., Cleveland, O.
Davis Engineering Corp., Elizabeth, N. J.
Drayer & Hanson, Inc., Los Angeles, Cal.
Economy Equipment Co., Inc., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
General Electric Co., Air Conditioning Dept., Bloomfield, N. J.
International Moistening Co., Providence, R. I.
Kauffman Air Conditioning Corp., St. Louis, Mo.
King Ventilating Co., Owatonna, Minn.
Manufacturers Fin Coil Co., Chicago, Ill.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
Niagara Blower Co., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Pfening Co., Fred D., Columbus, O.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
Research Corp., New York, N. Y.
Richmond Engineering Co., Richmond, Va.
Ross Engineering Corp., J. O., New York, N. Y.
●Somers, Inc., H. J., Detroit, Mich.
Sturtevant Co., B. F., Boston, Mass.
Thermal Units Mfg. Co., Div. of Air Devices Corp., Meriden, Conn.
●Trane Co., La Crosse, Wis.

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Unified Air Conditioner Co., Duluth, Minn.
●Unit Heater & Cooler Co., Wausau, Wis.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNIT HEATERS

See Heaters, Unit

UNIT VENTILATORS

See Ventilators, Unit

UNITS, WINDOW VENTILATOR AND FILTER

Airgard Mfg. Co., Chicago, Ill.
Berger Mfg. Div., Republic Steel Corp., Canton, O.
Berns Specialty Co., Chicago, Ill.
Burrowes Corp., Portland, Me.
●Carrier Corp., Syracuse, N. Y.
Coppus Engineering Corp., Worcester, Mass.
Davies Air Filter Corp., New York, N. Y.
Falstrom Co., Passaic, N. J.
Ilg Electric Ventilating Co., Chicago, Ill.
Kaiser Co., H. S., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Mayflower-Lewis Corp., St. Paul, Minn.
Mellish & Murray Co., Chicago, Ill.
National Laboratories, Inc., Boston, Mass.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Pioneer Air Conditioning Corp., Minneapolis, Minn.
Reed Unit-Fans, Inc., New Orleans, La.
Switzer-Cummins Co., Indianapolis, Ind.
●Somers, Inc., H. J., Detroit, Mich.
Standard Air Conditioning, Inc., New York, N. Y.
Staynew Filter Corp., Rochester, N. Y.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
Unified Air Conditioner Co., Duluth, Minn.
Utility Fan Corp., Los Angeles, Cal.
Westinghouse Electric & Mfg. Co., Cleveland, O.

VACUUM GAGES

See Gages, Vacuum

VACUUM HEATING SYSTEMS

See Systems, Heating, Vacuum

VACUUM PUMPS

See Pumps, Vacuum

VACUUM RECORDERS

See Recorders, Vacuum

VALVE OPERATORS

See Operators, Valve

VALVES, ANGLE

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
●American Brass Co., Waterbury, Conn.
American Radiator Co., New York, N. Y.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
Central Brass Mfg. Co., Cleveland, O.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Gorton Heating Corp., Cranford, N. J.
●Grinnell Co., Inc., Providence, R. I.
Hasco Valve & Machine Co., Milwaukee, Wis.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
Milwaukee Valve Co., Milwaukee, Wis.
Monat Valve & Forge Co., Inc., Pittsburgh, Pa.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Pittsburgh Valve Foundry & Construction Co., Pittsburgh, Pa.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Schutte & Koerting Co., Philadelphia, Pa.
Stockham Pipe Fittings Co., Birmingham, Ala.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, BLOW-OFF

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Babcock & Wilcox Co., New York, N. Y.
Barrett Machine Co., N. S. Pittsburgh, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Elliott Co., Jeannette, Pa.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Keckley Co., O. C., Chicago, Ill.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
Merco Nordstrom Valve Co., Pittsburgh, Pa.
Ohio Injector Co., Wadsworth, O.
Parker Appliance Co., Cleveland, O.
Pittsburgh Valve Foundry & Construction Co., Pittsburgh, Pa.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
●Yarnall-Waring Co., Philadelphia, Pa.

VALVES, CHECK

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
American Hard Rubber Co., New York, N. Y. (Hard rubber)
American Radiator Co., New York, N. Y.
Barrett, Haentjens & Co., Hazelton, Pa.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
Central Brass Mfg. Co., Cleveland, O.
Central Forging Co., Catawissa, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
Eclipse Fuel Engineering Co., Rockford, Ill.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fairbanks Co., New York, N. Y.
Foster Engineering Co., Newark, N. J.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
●Grinnell Co., Inc., Providence, R. I.
Hasco Valve & Machine Co., Milwaukee, Wis.
Henry Valve Co., Chicago, Ill.
Hoosick Engineering Co., Inc., Hoosick Falls, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Locke Regulator Co., Salem, Mass.
Lonergan Co., J. E., Philadelphia, Pa. (Hydraulic)
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
Milwaukee Valve Co., Milwaukee, Wis.
Mueller Co., Decatur, Ill.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Ruggles-Klingemann Mfg. Co., Salem, Mass. (Bleeder type)
Schutte & Koerting Co., Philadelphia, Pa.
Smolensky Valve Co., Inc., Cleveland, O.
Stockham Pipe Fittings Co., Birmingham, Ala.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.
Williams Gauge Co., Pittsburgh, Pa. (Noiseless)

VALVES, DIAPHRAGM

American Radiator Co., New York, N. Y.
Atlas Valve Co., Inc., Newark, N. J.
Belfield Co., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Cooper Co., Clark, Philadelphia, Pa.
Davis Regulator Co., Chicago, Ill.

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Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
Eclipse Fuel Engineering Co., Rockford, Ill.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
General Controls Co., Glendale, Cal.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller Co., Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Northern Indiana Brass Co., Elkhart, Ind.
Parks-Cramer Co., Fitchburg, Mass.
Powell Co., Wm., Cincinnati, O.
●Powers Regulator Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Strong, Carlisle & Hammond Co., The Cleveland, O.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
●Trane Co., La Crosse, Wis.
Trerice Co., H. O., Detroit, Mich.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●White-Rodgers Electric Co., St. Louis, Mo.

VALVES, FLOAT

Air Conditioning Supply Co., Cleveland, O.
American Radiator Co., New York, N. Y.
Atlas Valve Co., Inc., Newark, N. J.
●Automatic Products Co., Milwaukee, Wis. (Oil)
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
●Cash Co., A. W., Decatur, Ill.
Central Brass Mfg. Co., Cleveland, O.
Chase Brass & Copper Co., Waterbury, Conn.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
Eclipse Fuel Engineering Co., Rockford, Ill.
Eddy Valve Co., Waterford, N. Y.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis.
●Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Locke Regulator Co., Salem, Mass.
Ludlow Valve Mfg. Co., Troy, N. Y.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Monash-Younker Co., Chicago, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schuette & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Stickle Steam Specialties Co., Indianapolis, Ind.
Swartwout Co., Cleveland, O.
●Trane Co., La Crosse, Wis.
Voss Co., J. H. H., New York, N. Y.
Watts Regulator Co., Lawrence, Mass.

VALVES, FORGED STEEL

Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Henry Valve Co., Chicago, Ill.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Brigeport, Conn.
Merco Nordstrom Valve Co., Pittsburgh, Pa.
Parker Appliance Co., Cleveland, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Schutte & Koerting Co., Philadelphia, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.

VALVES, GATE, BRASS AND BRONZE

●American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
Belknap Mfg. Co., Bridgeport, Conn.
Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Chase Brass & Copper Co., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
Eddy Valve Co., Waterford, N. Y.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Hammond Brass Wks., Hammond, Ind.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
Milwaukee Valve Co., Milwaukee, Wis.
Monat Valve & Forge Co., Inc., Pittsburgh, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Scott Valve Mfg. Co., Detroit, Mich.
Stockham Pipe Fittings Co., Birmingham, Ala.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GATE, IRON BODY

Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Eddy Valve Co., Waterford, N. Y.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Hasco Valve & Machine Co., Milwaukee, Wis.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Monat Valve & Forge Co., Inc., Pittsburgh, Pa.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Valve & Fittings Co., Barberton, O.
Pittsburgh Valve Foundry & Construction Corp., Pittsburgh, Pa.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Rensaeller Valve Co., Cohoes, N. Y.
Scott Valve Mfg. Co., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GATE, STEEL

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Everlasting Valve Co., Jersey City, N. J.
Hasco Valve & Machine Co., Milwaukee, Wis.
●Jenkins Bros., New York, N. Y.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore. Inc., Hancock Valve Div., Bridgeport, Conn.
Monat Valve & Forge Co., Inc., Pittsburgh, Pa.
Parker Appliance Co., Cleveland, O.
Pittsburgh Valve Fdry. & Construction Co., Pittsburgh, Pa.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Walworth Co., New York, N. Y.

VALVES, GLOBE, BRASS AND BRONZE

●American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.

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Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
Central Brass Mfg. Co., Cleveland, O.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Chase Brass & Copper Co., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
●Fairbanks Co., New York, N. Y.
●Grinnell Co., Inc., Providence, R. I.
Hammond Brass Wks., Hammond, Ind.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
Milwaukee Valve Co., Milwaukee, Wis.
Monat Valve & Forge Co., Inc., Pittsburgh, Pa.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Stockham Pipe Fittings Co., Birmingham, Ala.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GLOBE, IRON BODY

Belfield Co., H., Philadelphia, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Edward Valve & Mfg. Co., East Chicago, Ind.
●Fairbanks Co., New York, N. Y.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
McAlear Mfg. Co., Chicago, Ill.
Monat Valve & Forge Co., Inc., Pittsburgh, Pa.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GLOBE STEEL

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Belfield Co., H., Philadelphia, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Clees Valve & Engineering Co., New York, N. Y.
●Crane Co., Chicago, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Hasco Valve & Machine Co., Milwaukee, Wis.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
McAlear Mfg. Co., Chicago, Ill.
Monat Valve & Forge Co., Inc., Pittsburgh, Pa.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Parker Appliance Co., Cleveland, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Schutte & Koerting Co., Philadelphia, Pa.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.

VALVES, LINED

American Hard Rubber Co., New York, N. Y. (Hard rubber lined)
Bordo Co., Inc., L. J., Glenside, Pa. (Lead, copper, tin, etc.)
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Goodrich Co., B. F., Akron, O. (Rubber lined)
●Jenkins Bros., New York, N. Y. (Tin)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead or tin)
National Lead Co., New York, N. Y. (Lead)
Northern Indiana Brass Co., Elkhart, Ind. (Tinned)
Resisto Pipe & Valve Co., East Cambridge, Mass. (Lead)
Schutte & Koerting Co., Philadelphia, Pa. (Lead)

VALVES, MIXING, STEAM AND WATER

Boiler Room Equipment, Inc., New York, N. Y.
Cooper Co., Clark, Philadelphia, Pa.
●Fulton Sylphon Co., Knoxville, Tenn.
●Johnson Service Co., Milwaukee, Wis.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Leonard Valve Co., Providence, R. I.
Leslie Co., Lyndhurst, N. J.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Thermo-Mix, Inc., Brooklyn, N. Y. (Thermostatic mixing valve for hot and cold water)

VALVES, MOTOR OPERATED

Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Barber-Colman Co., Rockford, Ill.
●Bell & Gossett Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Cutler-Hammer, Inc., Milwaukee, Wis.
Darling Valve & Mfg. Co., Williamsport, Pa.
Davis Regulator Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fairbanks Co., New York, N. Y.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Baltimore, Md.
General Controls Co., Glendale, Cal.
General Electric Co., Schenectady, N. Y.
Hasco Valve & Machine Co., Milwaukee, Wis.
Homestead Valve Mfg. Co., Coraopolis, Pa.
●Illinois Engineering Co., Chicago, Ill.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monat Valve & Forge Co., Inc., Pittsburgh, Pa.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
North American Mfg. Co., Cleveland, O.
Powell Co., Wm., Cincinnati, O.
R-S Products Corp., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., Inc., New York, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Sterling Engineering Co., Milwaukee, Wis.
●Tallmadge & Co., Webster, East Orange, N. J.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

VALVES, NEEDLE

Central Brass Mfg. Co., Cleveland, O.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
Edward Valve & Mfg. Co., East Chicago, Ind.
Henry Valve Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lapp Insulator Co., Inc., Le Roy, N. Y. (Porcelain)
Lonergan Co., J. E., Philadelphia, Pa.
Lukenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
Milwaukee Valve Co., Milwaukee, Wis.
Ohio Injector Co., Wadsworth, O.
Parker Appliance Co., Cleveland, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

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VALVES, PLUG

Barrett, Haentjens & Co., Hazelton, Pa.
Barrett Machine Co., N. S., Pittsburgh, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., East Chicago, Ind.
●Fairbanks Co., New York, N. Y.
Gorton Heating Corp., Cranford, N. J.
Hasco Valve & Machine Co., Milwaukee, Wis.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
●Jenkins Bros., New York, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Merco Nordstrom Valve Co., Pittsburgh, Pa. (Lubricated)
Monat Valve & Forge Co., Inc., Pittsburgh, Pa.
Mueller Co., Decatur, Ill.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Injector Co., Wadsworth, O.
Parker Appliance Co., Cleveland, O.
Pittsburgh Brass Mfg. Co., Pittsburgh, Pa.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, PRESSURE REDUCING AND REGULATING

●American District Steam Co., North Tonawanda, N. Y.
American Injector Co., Detroit, Mich.
American Radiator Co., New York, N. Y.
Atlas Valve Co., Inc., Newark, N. J.
Bailey Meter Co., Cleveland, O.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Belfield Co., H., Philadelphia, Pa.
●Bell & Gossett Co., Chicago, Ill.
Boylston Steam Specialty Co., Chicago, Ill.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Central Brass Mfg. Co., Pittsburgh, Pa.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
d'Este Co., Julian, Charlestown, Mass.
●Dunham Co., C. A., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Hoosick Engineering Co., Inc., Hoosick Falls, N. Y.
●Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Norgren Co., Inc., C. A., Denver, Colo.
Parker Appliance Co., Cleveland, O.
●Powers Regulator Co., Chicago, Ill.
Republic Flow Meters Co., Chicago, Ill.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.
Trerice Co., H. O., Detroit, Mich.
Triplex Mfg. Co., Peru, Ind.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
X L Refrigerating Co., Chicago, Ill.
York Oil Burner Co., Inc., York, Pa.

VALVES, RADIATOR, AIR

●American Radiator Co., New York, N. Y.
Anderson Products, Inc., Cambridge, Mass.
Au-Temp-Co Corp., New York, N. Y.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
●Burnham Boiler Corp., Irvington, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Specialty Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Dole Valve Co., Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
Hoffman Specialty Co., Inc., Waterbury, Conn.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Keeney Mfg. Co., Newington, Conn.
Little Mfg. Co., M. S., Hartford, Conn.
●Maid-O-Mist, Inc., Chicago, Ill. (Humidifying)
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Monash-Younker Co., Chicago, Ill.
Murdock Mfg. & Supply Co., Cincinnati, O.
National Metal Products Corp., Chicago, Ill.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
New York Air Valve Corp., New York, N. Y.
Russell & Co., W. A., New York, N. Y.
Slater Mfg. Co., Wakefield, Mass.
Sterling Engineering Co., Milwaukee, Wis.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, ELECTRIC

American Radiator Co., New York, N. Y.
Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Cooper Co., Clark, Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Valve Mfg. Co., Inc., New York, N. Y.
●Fulton Sylphon Co., Knoxville, Tenn.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
McCorkle Co., D. H., Berkeley, Cal.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Sarco Co., Inc., New York, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, PNEUMATIC

●Johnson Service Co., Milwaukee, Wis.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenburg Instrument Div., Bridgeport, Conn.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.
●Taylor Instrument Companies, Rochester, N. Y.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, SELF-CONTAINED

American Radiator Co., New York, N. Y.
Au-Temp-Co Corp., New York, N. Y.
Edison, Inc., Thos. A., Edison Electrical Controls Div., West Orange, N. J.
●Fulton Sylphon Co., Knoxville, Tenn.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., Bridgeport, Conn.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Powers Regulator Co., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
●Tallmadge & Co., Webster, East Orange, N. J.
●Taylor Instrument Companies, Rochester, N. Y.
●Trane Co., La Crosse, Wis.

VALVES, RADIATOR, STEAM AND HOT WATER

American Radiator Co., New York, N. Y.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Bishop & Babcock Mfg. Co., Cleveland, O.
●Burnham Boiler Corp., Irvington, N. Y.
Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
●Fairbanks Co., New York, N. Y.
Gorton Heating Corp., Cranford, N. J.
●Grinnell Co., Inc., Providence, R. I.
Haines & Co., William S., Philadelphia, Pa.
Hammond Brass Wks., Hammond, Ind.
Hoffman Specialty Co., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Keeney Mfg. Co., Newington, Conn.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Fdry. Co., Eureka Valve Div., Cincinnati, O.

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Pierce, Butler Radiator Corp., Syracuse, N. Y.
Powell Co., Wm., Cincinnati, O.
●Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
●Trane Co., La Crosse, Wis.
Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, RADIATOR, STEAM AND HOT WATER, MODULATING

●American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Barnes & Jones, Inc., Boston, Mass.
Belknap Mfg. Co., Bridgeport, Conn.
Bishop & Babcock Mfg. Co., Cleveland, O.
Capitol Brass Div., Bohn Aluminum & Brass Corp., Detroit, Mich.
Cashin Co., W. D. Boston, Mass.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Cryer Trap & Valve Co., Inc., New York, N. Y.
●Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
●Fulton Sylphon Co., Knoxville, Tenn.
Gorton Heating Corp., Cranford, N. J.
Haines & Co., William S., Philadelphia, Pa.
Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Mouat Vapor Heating Co., The, Cleveland, O.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Ohio Brass Co., Mansfield, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
●Sarco Co., Inc., New York, N. Y.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
●Tallmadge & Co., Webster, East Orange, N. J.
●Trane Co., La Crosse, Wis.
●Webster & Co., Warren, Camden, N. J.

VALVES, REFRIGERATION (ANGLE, CHECK, GATE, GLOBE, NEEDLE, RELIEF)

Belknap Mfg. Co., Bridgeport, Conn.
●Crane Co., Chicago, Ill.
Henry Valve Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kerotest Mfg. Co., Pittsburgh, Pa.
Monat Valve & Forge Co., Inc., Pittsburgh, Pa.
Mueller Brass Co., Port Huron, Mich.
Parker Appliance Co., Cleveland, O.
Peerless of America, Inc., Chicago, Ill.
Perfection Refrigeration Parts Co., Harvey, Ill.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Superior Valve and Fittings Co., Pittsburgh, Pa.
Triumph Ice Machine Co., Cincinnati, O.
●Vilter Mfg. Co., Milwaukee, Wis.
Voss, Inc., J. H. H., New York, N. Y.
Walworth Co., New York, N. Y.
●Worthington Pump & Machinery Corp., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, BACK PRESSURE

Burrows Mfg. Co., F. A., York, Pa.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Electrimatic Corp., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Imperial Brass Mfg. Co., Chicago, Ill.
Mueller Brass Co., Port Huron, Mich.
●York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, EXPANSION, CONSTANT PRESSURE

●Alco Valve Co., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Automatic Products Co., Milwaukee, Wis.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
●Detroit Lubricator Co., Detroit, Mich.
Fedders Mfg. Co., Inc., Buffalo, N. Y.
Foster Engineering Co., Newark, N. J.
●Fulton Sylphon Co., Knoxville, Tenn.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., Bridgeport, Conn.
Mercoid Corp., Chicago, Ill.
Peerless of America, Inc., Chicago, Ill.
Perfection Refrigeration Parts Co., Harvey, Ill.
Pierce, Butler Radiator Corp., Syracuse, N. Y.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Superior Valve and Fittings Co., Pittsburgh, Pa.
●Taylor Instrument Companies, Rochester, N. Y.
Triumph Ice Machine Co., Cincinnati, O.
Vogt Machine Co., Henry, Louisville, Ky.
X L Refrigerating Co., Chicago, Ill.

VALVES, REFRIGERATION, EXPANSION, THERMOSTATIC

●Alco Valve Co., Inc., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Automatic Products Co., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
Fedders Mfg. Co., Inc., Buffalo, N. Y.
Larkin Coils, Inc., Atlanta, Ga.
Mayson Mfg. Co., Inc., Detroit, Mich.
Mercoid Corp., Chicago, Ill.
Peerless of America, Inc., Chicago, Ill.
Perfection Refrigeration Parts Co., Harvey, Ill.
●Spoehrer-Lange Co., St. Louis, Mo.
Sterling Engineering Co., Milwaukee, Wis.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
●Taylor Instrument Companies, Rochester, N. Y.
Torrey Refrigeration Products, Los Angeles, Cal.
Voss Co., J. H. H., New York, N. Y.
X L Refrigerating Co., Chicago, Ill.

VALVES, REFRIGERATION, FLOAT, HIGH PRESSURE

●Alco Valve Co., Inc., St. Louis, Mo.
American Injector Co., Detroit, Mich.
Fedders Mfg. Co., Inc., Buffalo, N. Y.
Foster Engineering Co., Newark, N. J.
●Frick Co., Waynesboro, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Perfection Refrigeration Parts Co., Harvey, Ill.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
●Taylor Instrument Companies, Rochester, N. Y.
●Vilter Mfg. Co., Milwaukee, Wis.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, MAGNETIC STOP

●Alco Valve Co., Inc., St. Louis, Mo.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
Cooper Co., Clark, Philadelphia, Pa.
●Detroit Lubricator Co., Detroit, Mich.
Electric Valve Mfg. Co., Inc., New York, N. Y.
Electrimatic Corp., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
General Controls Co., Glendale, Cal.
Mercoid Corp., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
●Sarco Co., Inc., New York, N. Y.
X L Refrigerating Co., Chicago, Ill.

VALVES, REFRIGERATION, WATER REGULATING, PRESSURE OR TEMPERATURE ACTUATED

●Cash Co., A. W., Decatur, Ill.
Central Brass Mfg. Co., Cleveland, O.
d'Este Co., Julian, Charlestown, Mass.
Electrimatic Corp., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Mercoid Corp., Chicago, Ill.
Mueller Co,. Decatur, Ill.
Penn Electric Switch Co., Goshen, Ind.
Perfection Refrigeration Parts Co., Harvey, Ill.
Shank, Cyrus, Chicago, Ill.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

VALVES, RELIEF

Ashton Valve Co., Cambridge, Mass.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
●Bell & Gossett Co., Chicago, Ill.
Boylston Steam Specialty Co., Chicago, Ill.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Central Brass Mfg. Co., Cleveland, O.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
d'Este Co., Julian, Charlestown, Mass.
●Detroit Lubricator Co., Detroit, Mich.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Fulflo Specialties Co., Inc., Blanchester, O. (Oil)
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Henry Valve Co., Chicago, Ill.
●Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kerotest Mfg. Co., Pittsburgh, Pa.

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Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Locke Regulator Co., Salem, Mass.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
Marsh Corp. Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
●Monarch Mfg. Wks., Inc., Philadelphia, Pa.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., New York, N. Y.
Norgren Co., Inc., C. A., Denver, Colo.
Parker Appliance Co., Cleveland, O.
Penberthy Injector Co., Detroit, Mich.
Powell Co., Wm., Cincinnati, O.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Spencer Thermostat Co., Attleboro, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Sterling Engineering Co., Milwaukee, Wis.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Swartwout Co., Cleveland, O.
Thrush & Co., H. A., Peru, Ind.
Triplex Mfg. Co., Peru, Ind.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
●Watson-Stillman Co., Roselle, N. J.
Watts Regulator Co., Lawrence, Mass.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
X L Refrigerating Co., Chicago, Ill.
York Oil Burner Co., Inc., York, Pa.

VALVES, SOLDER JOINT

●American Brass Co., Waterbury, Conn.
American Radiator Co., New York, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
●Jenkins Bros., New York, N. Y.
Kerotest Mfg. Co., Pittsburgh, Pa.
Milwaukee Valve Co., Milwaukee, Wis.
Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Powell Co., Wm., Cincinnati, O.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Walworth Co., New York, N. Y. (Brazed)
Williams Valve Co., D. T., Cincinnati, O.

VALVES, SOLENOID

●Alco Valve Co., Inc., St. Louis, Mo.
Anderson Products, Inc., Cambridge, Mass.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Belfield Co., H., Philadelphia, Pa.
Brown Instrument Co. Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
Davis Regulator Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Electric Valve Mfg. Co., Inc., New York, N. Y.
Electrimatic Corp., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Friez & Sons, Julien P., Baltimore, Md.
General Controls Co., Glendale, Cal.
General Electric Co., Schenectady, N. Y.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Hays Corp., Michigan City, Ind.
Hammett Mfg. Co., Kansas City, Mo.
Hunt & Son, C. B., Salem, O.
Keckley Co., O. C., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monat Valve & Forge Co., Inc., Pittsburgh, Pa.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Parker Appliance Co., Cleveland, O.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pfening Co., Fred D., Columbus, O.
R-S Products Corp., Philadelphia, Pa.
Rega Mfg. Co., Rochester, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., Inc., New York, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
●Spoehrer-Lange Co., St. Louis, Mo.
Supreme Electric Products Corp., Rochester, N. Y.
Wheelco Instruments Co., Chicago, Ill.

VALVES, 2, 3, AND 4 WAY

●American Brass Co., Waterbury, Conn.
Barber-Colman Co., Rockford, Ill.
Belfield Co., H., Philadelphia, Pa.
Bordo Co., Inc., Glenside, Pa.
●Cash Co., A. W., Decatur, Ill.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
General Controls Co., Glendale, Cal.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Johnson Service Co., Milwaukee, Wis.
Kerotest Mfg., Pittsburgh, Pa.
Lunkenheimer Co., Cincinnati, O.
Merco Nordstrom Valve Co., Pittsburgh, Pa.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Mueller Brass Co., Port Huron, Mich.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Parker Appliance Co., Cleveland, O.
Penn Electric Switch Co., Goshen, Ind.
Powell Co., Wm., Cincinnati, O.
●Powers Regulator Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Smolensky Valve Co., Inc., Cleveland, O.
Spence Engineering Co., Inc., Walden, N. Y.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Walworth Co., New York, N. Y. (Lubricated plug valves)
Weatherhead Co., Cleveland, O.
Williams Valve Co., D. T., Cincinnati, O.

VAPOR HEATING SYSTEMS

See Systems, Heating, Vapor

V-BELT DRIVES

See Drives, V-Belt

VELOCITY REGULATORS

See Regulators, Air Velocity

VENETIAN BLINDS

See Blinds, Venetian

VENTILATORS, MUSHROOM

American Blower Corp., Detroit, Mich.
Best Register Co., Milwaukee, Wis.
Falstrom Co., Passaic, N. J.
Jordan & Co., Paul R., Indianapolis, Ind.
Knowles Mushroom Ventilator Co., New York, N. Y.
Milcor Steel Co., Milwaukee, Wis.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Niagara Blower Co., New York, N. Y.
●Tuttle & Bailey, Inc., New Britain, Conn.
Ventilating Products Co., Chicago, Ill.

VENTILATORS, ROOF, FAN

Aeolus Dickinson Co., Chicago, Ill.
Air Controls, Inc., Cleveland, O.
Akrat Ventilator Co., Chicago, Ill.
Allen Corp., Detroit, Mich.
American Blower Corp., Detroit, Mich.
American-Larson Ventilating Co., Pittsburgh, Pa.
American Radiator Co., New York, N. Y.
Arex Co., Chicago, Ill.
●Autovent Fan & Blower Co., Chicago, Ill.
Belanger Fan & Oven Co., Detroit, Mich.
Burt Mfg. Co., Akron, O.
Davidson Hy Duty Roof Fan Co., Newton, Mass.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Falstrom Co., Passaic, N. J.
Goethel Co., Alfred C., Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Corp., Grand Rapids, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.
International Engineering, Inc., Dayton, O.
Iona Ventilator Co., Inc., Philadelphia, Pa.
Johnson Fan & Blower Corp., Chicago, Ill.
Jordan & Co., Paul R., Indianapolis, Ind.
Kernchen Co., Chicago, Ill.
Lohman, Inc., Wm. J., New York, N. Y.
Mellish & Murray Co., Chicago, Ill.
Merchant & Evans Co., Philadelphia, Pa.
Myers Electric Co., Pittsburgh, Pa.
Propellair, Inc., Springfield, O.
Reed Unit-Fans, Inc., New Orleans, La.
Robertson Co., H. H., Pittsburgh, Pa.
Royal Ventilator Co., Philadelphia, Pa.
●Somers, Inc., H. J., Detroit, Mich.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Swartwout Co., Cleveland, O.
Tierney Rotor Ventilator Co., Minneapolis, Minn.
Uno Ventilator Co., Cliftondale, Mass.
Viking Air Conditioning Corp., Cleveland, O.
Washburne & Co., E. G., New York, N. Y.
Western Engineering & Mfg. Co., Los Angeles, Cal.
●Wing Mfg. Co., L. J., New York, N. Y.

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VENTILATORS, ROOF, GRAVITY

Accurate Mfg. Works, Chicago, Ill.
Aeolus Dickinson Co., Chicago, Ill.
●Airtherm Mfg. Co., St. Louis, Mo.
Akrat Ventilator Co., Chicago, Ill.
Allen Corp., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American-Larson Ventilating Co., Pittsburgh, Pa.
Ames Co., W. R., San Francisco, Cal.
Arex Co., Chicago, Ill.
Autoforce Ventilating System, Boston, Mass.
Burt Mfg. Co., Akron, O.
Century Fan & Ventilator Co., New York, N. Y.
Chicago Metal Mfg. Co., Chicago, Ill.
Falstrom Co., Passaic, N. J.
Globe Ventilating Co., Troy, N. Y.
Goethel Co., Alfred C., Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Hirschmann Co., W. F., Buffalo, N. Y.
Iona Ventilator Co., Inc., Philadelphia, Pa.
Jamar Co., Walker, Duluth, Minn.
Jordan & Co., Paul R., Indianapolis, Ind.
Kernchen Co., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
Kleenaire Corp., Stevens Point, Wis.
Lee & Son Co., Thomas, Cincinnati, O.
Mellish & Murray Co., Chicago, Ill.
Milcor Steel Co., Milwaukee, Wis.
Pioneer Roofing & Sheet Metal Co., Muskogee, Okla.
Robertson Co., H. H., Pittsburgh, Pa.
Royal Ventilator Co., Philadelphia, Pa.
Schoedinger, F. O., Columbus, O.
Swartwout Co., Cleveland, O.
Uno Ventilator Co., Cliftondale, Mass.

VENTILATORS, UNIT

Arex Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
Nelson Corp., Herman, Moline, Ill.
●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Schwitzer-Cummins Co., Indianapolis, Ind.
Sturtevant Co., B. F., Boston, Mass.
Swartwout Co., Cleveland, O.
●Trane Co., La Crosse, Wis.

VIBRATION ELIMINATORS

See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration

VIBRATION ISOLATORS

See Bases and Pads, Vibration Isolating; Hose, Metal for Eliminating Compressor Vibration

VISCOUS LIQUID PUMPS

See Pumps, Viscous Liquids

VISES, PIPE

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Athol Machine & Foundry Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Crown Die & Tool Co., Chicago, Ill.
Desmond-Stephen Mfg. Co., Urbana, Ill.
Erie Tool Wks., Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
International Nutyp Tool Corp., Oswego, N. Y.
Jarecki Mfg. Co., Erie, Pa.
Nye Tool & Machine Wks., The, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O.
Trimont Mfg. Co., Roxbury Mass.
Vanderman Mfg. Co., Willimantic, Conn.
Walworth Co., New York, N. Y.
●Williams & Co., J. H., New York, N. Y.
Yost Mfg. Co., Meadville, Pa.

VISE STANDS

See Stands, Vise

WALL THERMOSTATS

See Thermostats, Room or Wall

WARM AIR FURNACES

See Furnaces, Warm Air

WASHERS, AIR

Air & Refrigeration Corp., New York, N. Y.
American Blower Corp., Detroit, Mich.
Ames Co., W. R., San Francisco, Cal.
●Autovent Fan & Blower Co., Chicago, Ill.
Ballantyne Co., Omaha, Neb.
Bayley Blower Co., Milwaukee, Wis.
Belanger Fan & Oven Co., Detroit, Mich.
Betz Air Conditioning Corp., Kansas City, Mo. (Vertical type)
Bishop & Babcock Mfg. Co., Cleveland, O.
Blower Application Co., Milwaukee, Wis.
Bubar, Hudson H., New York, N. Y.
●Buffalo Forge Co., Buffalo, N. Y.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Columbian Steel Tank Co., Kansas City, Mo.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
King Ventilating Co., Owatonna, Minn.
Mellish & Murray Co., Chicago, Ill.
Montag Stove & Furnace Wks., Portland, Ore.
Mueller Furnace Co., L. J., Milwaukee, Wis.
National Air Conditioning & Engineering Corp., Kansas City, Mo.
New York Blower Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Northern Blower Co., Cleveland, O.
Nugent Sons, Inc., Thos., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Penn Cooling Tower Wks., Pittsburgh, Pa.
Ross Engineering Corp., J. O., New York, N. Y.
Spray Engineering Co., Somerville, Mass.
Stilphen Engineering & Mfg. Co., C. A., Denver, Colo.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Sturtevant Co., B. F., Boston, Mass.
Supreme Heater & Ventilating Corp., St. Louis, Mo.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
●Trane Co., La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
●Unit Heater & Cooler Co., Wausau, Wis.
Utica Radiator Corp., Utica, N. Y.
Utility Fan Corp., Los Angeles, Cal.
●York Ice Machinery Corp., York, Pa.

WATER CHILLERS

See Chillers, Water, for Air Conditioning and Refrigeration

WATER HEATERS

See Heaters, Water

WATER METERS

See Meters, Water

WATER TREATMENT

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Hydrozone Co., Inc., New York, N. Y.
Aquatic Chemical Laboratories, Inc., New York, N. Y.
Bird-Archer Co., New York, N. Y.
Builders Iron Foundry, Providence, R. I.
Dampney Co. of America, Boston, Mass.
Elgin Softener Corp., Elgin, Ill.
Ferro-Nil Corp., New York, N. Y.
Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
Grief, Edward C., Bogota, N. J.
Haering Co., D. W., Chicago, Ill.
Hagan Corp., Pittsburgh, Pa.
Metropolitan Refining Co., Long Island City, N. Y.
Mutual Chemical Co. of America, New York, N. Y.
National Aluminate Corp., Chicago, Ill.
Oakite Products, Inc., New York, N. Y.
Permutit Co., New York, N. Y.
R. U. V. Engineering Corp., New York, N. Y.
Refinite Corp., Omaha, Neb.
Research Products Corp., Madison, Wis.
Uniflow Mfg. Co., Erie, Pa.
Water Refining Co., Ft. Wayne, Ind.

WATER VAPOR REFRIGERATION

See Compressors, Refrigerating, Centrifugal and Compressors, Refrigerating, Steam Jet

WEATHER STRIPS, METAL

All Metal Weatherstrip Co., Chicago, Ill.
Athey Co., Chicago, Ill.
Barland Weatherstrip Material Co., Cleveland, O.
Burrowes Corp., Portland, Me.
Chamberlin Metal Weather Strip Co., Detroit, Mich.
Higgin Products, Inc., Newport, Ky.
Kane Mfg. Corp., Kane, Pa.
Monarch Metal Weatherstrip Co., St. Louis, Mo.
Northern Weatherstrip Co., Duluth, Minn.
Vento Steel Sash Co., Muskegon, Mich.
Western Felt Wks., Chicago, Ill. (Felt)
Yardley Screen & Weather Strip Co., Columbus, O.

WELDERS, ARC

Adams Mfg. Co., J. D., Indianapolis, Ind.
Burke Electric Co., Erie, Pa.
Commonwealth Mfg. Corp., Cincinnati, O.
Crise Elec. Mfg. Co., Mount Vernon, O.
Eisler Engineering Corp., Newark, N. J.
General Electric Co., Schenectady, N. Y.
General Equipment Co., Wichita, Kan.
Giant Grip Mfg. Co., Oshkosh, Wis.
Hammett Mfg. Co., Kansas City, Mo.
Harnischfeger Corp., Milwaukee, Wis.
Hobart Bros., Troy, O.
Hollup Corp., Chicago, Ill.
Ideal Electric & Mfg. Co., Mansfield, O.
Imperial Electric Co., Akron, O.
Lincoln Electric Co., Cleveland, O.
Maple Valley Mfg. Co., Mapleton, Ia.
Marquette Mfg. Co., Minneapolis, Minn.

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Master Welders, Kansas City, Mo.
Miller Electric Mfg. Co., Appleton, Wis.
Ohio Welder Co., Middlefield, O.
Owen-Dyneto Corp., Syracuse, N. Y.
Smith Welding Equipment Co., Minneapolis, Minn.
Una Welding, Inc., Cleveland, O.
Universal Power Corp., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Will-Weld Mfg. Co., Inc., Omaha, Neb.
Wilson Welder & Metals Co., Inc., New York, N. Y.

WELDERS, SPOT

Canatsey Electric Mfg. Co., Kansas City, Mo.
Eisler Engineering Corp., Newark, N. J.
General Electric Co., Schenectady, N. Y.
Hammett Mfg. Co., Kansas City, Mo.
Universal Power Corp., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

WELDING AND CUTTING APPARATUS, OXY-ACETYLENE

Air Reduction Sales Co., New York, N. Y.
Bastian-Blessing Co., Chicago, Ill.
Burdett Mfg. Co., Chicago, Ill.
Carbo-Oxygen Co., Pittsburgh, Pa.
Dockson Co., C. H., Detroit, Mich.
Douglass Pipe Machine Co., St. Joseph, Mich.
Gasweld Equipment Co., Chicago, Ill.
Harris Calorific Co., Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
●Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Milburn Co., Alexander, Baltimore, Md.
Oster Mfg. Co., Cleveland, O.
Modern Engineering Co., St. Louis, Mo.
Sight Feed Generator Co., Richmond, Ind.
Smith Welding Equipment Co., Minneapolis, Minn.
Torchweld Equipment Co., Chicago, Ill.

WELDING ROD

See Rod, Welding

WHEELS, BLOWER

Air Controls, Inc., Cleveland, O.
American Blower Corp., Detroit, Mich.
●Autovent Fan & Blower Co., Chicago, Ill.
Bishop & Babcock Mfg. Co., Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
Economy Electric Mfg. Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
Mueller Furnace Co., L. J., Milwaukee, Wis.
New York Blower Co., Chicago, Ill.
Peerless Electric Co., Warren, O.
Schwitzer-Cummins Co., Indianapolis, Ind.
Sturtevant Co., B. F., Boston, Mass.
Torrington Mfg. Co., Torrington, Conn.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Viking Air Conditioning Corp., Cleveland, O.

WINDOW VENTILATOR AND FILTER UNITS

See Units, Window Ventilator and Filter

WINDOW WEATHERSTRIP

See Weatherstrip, Window, Metal

WINDOWS, HEAT INSULATING

Chamberlin Metal Weather Strip Co., Detroit, Mich.
Libbey-Owens Ford Glass Co., Toledo, O.
Russell Insulation Co., F. C., Cleveland, O.
Truscon Steel Co., Youngstown, O.

WOOD PIPE

See Pipe, Wood

WRENCHES, ADJUSTABLE

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Bonney Forge & Tool Works, Allentown, Pa.
Erie Tool Works, Erie, Pa.
Peck, Stow & Wilcox Co., Southington, Conn.
Snap-On Tools Corp., Kenosha, Wis.
Trimont Mfg. Co., Boston, Mass.
●Williams & Co., J. H., New York, N. Y.

WRENCHES, OPEN END

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Bonney Forge & Tool Works, Allentown, Pa.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

WRENCHES, PIPE

Armstrong Bros. Tool Co., Chicago, Ill.
Bernz Co., Inc., Otto, Rochester, N. Y.
Billings & Spencer Co., Hartford, Conn.
Bonney Forge & Tool Works, Allentown, Pa.
Erie Tool Works, Erie, Pa.
Greene, Tweed & Co., New York, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
International Nutyp Tool Corp., Oswego, N. Y.
Ridge Tool Co., Elyria, O.
Trimont Mfg. Co., Boston, Mass.
U. S. Hame Co., Buffalo, N. Y.
Walworth Co., New York, N. Y.

WRENCHES, RATCHET

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Bonney Forge & Tool Works, Allentown, Pa.
Greene, Tweed & Co., New York, N. Y.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

WRENCHES, SOCKET

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Blackhawk Mfg. Co., Milwaukee, Wis.
Bonney Forge & Tool Works, Allentown, Pa.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

WRENCHES, TORQUE INDICATING

Bonney Forge & Tool Works, Allentown, Pa.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

WROUGHT IRON PIPE

See Pipe, Wrought Iron

X-RAY MACHINES AND FILM

See Machines and Film, X-Ray

ZINC SHEETS

See Sheets, Zinc

ZONE CONTROLS

See Systems, Heating, Zone Control

● Advertisement in this issue. See Index to Advertisers, page 168.

DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS

PART 2—TRADE NAMES

A. B. C.—Ventilators. American Blower Corp., Detroit, Mich.

A. G. P.—Burners, heaters. American Gas Products, Div. of American Radiator Co., New York, N. Y.

A-P—Humidistats, damper operators, regulators, relays, thermostats, valves. Automatic Products Co., Milwaukee, Wis.

ARRC—Fittings. Union Metal Wks., Inc., Chelsea, Mass.

Abrasoweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Absorbex — Insulation. Celotex Corp., The, Chicago, Ill.

Ace—Pipe, pipe and fittings, valves, pumps. American Hard Rubber Co., New York, N. Y.

Acme—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Acousti - Celotex — Insulation. Celotex Corp., The, Chicago, Ill.

Acoustilite — Insulation. Insulite Co., Minneapolis, Minn.

Acousti-Vent—Insulation. Burgess Battery Co., Chicago, Ill.

Adco—Unit heaters, unit air conditioners, unit air coolers. Air Devices Corp., Meriden, Conn.

Adjusto—Packing. Keasbey & Mattison Co., Ambler, Pa.

Adsco—Conduit, heaters, heat exchangers, joints, meters, pipe, pipe hangers and supports, separators, strainers, regulators, valves. American District Steam Co., North Tonawanda, N. Y.

Aeracool — Blades, fans, ventilators. Myers Electric Co., Pittsburgh, Pa.

Aeratherm—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Aeriet—Fans, unit heaters. Air Devices Corp., Meriden, Conn.

Aerisweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Aero—Radiation. National Radiator Corp., Johnstown, Pa.

Aero-Art—Radiation. National Radiator Corp., Johnstown, Pa.

Aerocrat—Fans, humidifiers, washers. Ames Co., W. R., San Francisco, Cal.

Aeroplex—Fans. Bayley Blower Co., Milwaukee, Wis.

Aerovalve—Ventilators. Knowles Mushroom Ventilator Co., New York, N. Y.

Affco—Dampers, grilles, louvers and shutters, ventilators. American Foundry & Furnace Co., Bloomington, Ill.

Air-Acoustic — Insulation. Johns-Manville, New York, N. Y.

Airblanket—Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Airco—Welding rod. Air Reduction Sales Co., New York, N. Y.

Air-Con—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Airco-DB—Gages, regulators, torches, welding and cutting apparatus. Air Reduction Sales Co., New York, N. Y.

Airefiner—Water treatment. Oakite Products, Inc., New York, N. Y.

Aire-Flo—Fans, unit air conditioners. Lennox Furnace Co., Marshalltown, Ia.

Airex—Fans, louvers and shutters. Mountain States Equipment Co., Denver, Colo.

Air flo — Dampers, louvers, damper quadrants, draft regulators. Air Conditioning Products Co., Detroit, Mich.

Airfoil—Fans. Aerovent Fan Co., Piqua, O.

Air-Gas-Pop — Valves. Lunkenheimer Co., Cincinnati, O.

Airguide—Hygrometers, thermometers, Fee and Stemwedel, Inc., Chicago, Ill.

Airheator — Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Airline—Grilles, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Air-Marvels—Fans. General Blower Co., Inc., Philadelphia, Pa.

Airmat Arrester—Dust collectors. American Air Filter Co., Inc., Louisville, Ky.

Airmeter—Hygrometers. Johnson Tool Co., East Providence, R. I.

Airmixt—Burners, furnaces. Williams, Inc., F. C., Dearborn, Mich.

Airofelt—Insulation. Johns-Manville, New York, N. Y.

"Air-o-Line"—Indicator-controllers, recorder-controllers. Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

Air-O-Matic—Unit air conditioners, refrigerating machines. Williams Oil-O-Matic Corp., Bloomington, Ill.

Airotherm—Zone control thermostat. Tallmadge & Co., Webster, East Orange, N. J.

Airplex—Air filters. Davies Air Filter Corp., New York, N. Y.

Air Stone—Conduit. Dockstader, S. E., Washington, D. C.

Airvector—Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Airxpel—Steam traps. Wright-Austin Co., Detroit, Mich.

Akon—Water treatment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Akron Red—Packing. Goodrich Co., B. F., Akron, O.

Alco—Ventilators. Allen Corp., Detroit, Mich.

Alkalex—Water treatment. Research Products Corp., Madison, Wis.

Allegheny—Sheets. Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

All-In-One—Tubing. Wolverine Tube Co., Detroit, Mich.

All-In-One—Unit air conditioners. Airtemp, Div. of Chrysler Corp., Dayton, O.

Almar—Pittsburgh lock forming machines. Ward Machinery Co., Chicago, Ill.

Alnor—Thermometers. Illinois Testing Laboratories, Chicago, Ill.

Alnor Velometer—Air velocity meters. Illinois Testing Laboratories, Chicago, Ill.

Aloyco—Stainless steel fittings, nipples, pipe, tubing, unions, valves. Alloy Steel Products Co., Linden, N. J.

Aluminweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Always Reliable—Benders, leak detectors, torches, wrenches. Bernz Co., Inc., Otto, Rochester, N. Y.

Ambler—Cement. Keasbey & Mattison Co., Ambler, Pa.

Amblerite—Packing. Keasbey & Mattison Co., Ambler, Pa.

Ambrac—Sheets, welding rod. American Brass Co., Waterbury, Conn.

Ambraloy—Tubing, welding rod. American Brass Co., Waterbury, Conn.

Amco—Humidifiers, humidistats, psychrometers, hygrometers. American Moistening Co., Providence, R. I.

Amco — Packing. Austin-Mason Co., New York, N. Y.

Amirglass—Filters. Amirton Co., New York, N. Y.

Anaconda—Fittings, pipe, welding rod, sheets, solder, tubing, valves. American Brass Co., Waterbury, Conn.

Anemotrol—Dampers. Anemostat Corp. of America, New York, N. Y.

Ankorite—Packing. Anchor Packing Co., Philadelphia, Pa.

Anode—Electrodes. Lincoln Electric Co., Cleveland, O.

Apex—Pipe cutting and threading machines. Merrell Mfg. Co., Toledo, O.

Apex—Quadrants. Ohio Products Co., Cleveland, O.

Apex—Recorders. Uehling Instrument Co., Paterson, N. J.

Apexior—Coatings. Dampney Co. of America, Hyde Park, Boston, Mass.

Apolloy—Sheets. Apollo Steel Co., Apollo, Pa.

Aqua-Air—Valves. Lunkenheimer Co., Cincinnati, O.

Aqualator—Circulators. Triplex Mfg. Co., Peru, Ind.

Aquaseal—Cement and compounds. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Aquazone—Humidifiers. Corozone Air Conditioning Corp., Cleveland, O.

Arc-Eng—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Arco—Boilers, eliminators, filters, fittings, pipe, plates, pumps, radiation, regulators, systems, tubing, valves, ventilators. American Radiator Co., New York, N. Y.

Arcoblast—Cooling and heating surface. American Radiator Co., New York, N. Y.

Arex-Austor—Roof ventilators. Arex Co., Chicago, Ill.

Aridifier—Separators. Logan Engineering Co., Chicago, Ill.

Arin—Louvers and shutters. Arex Co., Chicago, Ill.

Aristocrat—Registers. Auer Register Co., Cleveland, O.

Armco—Sheets. American Rolling Mill Co., Middletown, O.

Armorak—Insulation. Keasbey Co., Robert A., New York, N. Y.

Arrow—Ventilators. Uno Ventilator Co., Cliftondale, Mass.

Artic—Refrigerants. du Pont de Nemours & Co., E. I., R. & H. Chemicals Dept., Wilmington, Del.

Asbestocel—Insulation. Johns-Manville, New York, N. Y.

Asco—Valves, relays, switches. Automatic Switch Co., New York, N. Y.

Ashcolite — Pipe. Allen-Sherman-Hoff Co., Philadelphia, Pa.

Atlas—Dampers. Brown, Wm. P., Springfield, Mass.

Atlas—Dampers. Hampden Cornice Wks., Inc., Springfield, Mass.

Atlas—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Atticvane—Fans. Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Auto-Klean—Filters, strainers. Cuno Engineering Corp., Meriden, Conn.

Automatic Butler—Stokers. Butler Mfg. Co., Kansas City, Mo.

Automatic Water-Tender—Valves. Air Conditioning Supply Co., Cleveland, O.

Autovent—Eliminators, valves. Maid-O-Mist, Inc., Chicago, Ill.

Autozone—Zone control unit. Tallmadge & Co., Webster, East Orange, N. J.

Axiom—Filters. Blocksom & Co., Michigan City, Ind.

B. B.—Electric motors. Brown-Brockmeyer Co., Dayton, O.

B & B—Pumps. Bishop & Babcock Mfg. Co., Cleveland, O.

BCA—Bearings. Bearings Co. of America, Lancaster, Pa.

B & C—Plates. Beaton & Corbin Mfg. Co., Southington, Conn.

B. & G.—Cement, heaters, relays, regulators, thermostats, valves. Bell & Gossett Co., Chicago, Ill.

B & K—Machines. Bignall & Keeler Machine Wks., Edwardsville, Ill.

B/W—Relays, switches. Bender Warrick Corp., Birmingham, Mich.

B & W—Boilers, burners, pipe, tubing, stokers, valves. Babcock & Wilcox Co., New York, N. Y.

Balmi-Aire—Unit air humidifiers. U. S. Air Conditioning Corp., Minneapolis, Minn.

Bankheat—Oil burners. Johnson Co., S. T., Oakland, Cal.

Barcol — Motors, regulators, thermostats, valves. Barber-Colman Co., Rockford, Ill.

Barlastic—Calking compounds. Barland Weatherstrip Material Co., Cleveland, O.

Barnes—Cutters. Erie Tool Works, Erie, Pa.

Battery—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Battleship—Packing. Keasbey & Mattison Co., Ambler, Pa.

Beacor—Valves. Beaton & Corbin Mfg. Co., Southington, Conn.

Bell—Cement. Keasbey & Mattison Co., Ambler, Pa.

Belmont—Packing. Belmont Packing & Rubber Co., Philadelphia, Pa.

Benco—Oil burners. Bennett Co., Omaha, Neb.

Bendix—Fans. Air Devices Corp., Meriden, Conn.

Bennett-Allison—Oil burners. Bennett Co., Omaha, Neb.

Benton—Boilers. Combination Boiler Co., Benton Harbor, Mich.

Berloy—Parts. Berger Mfg. Div., Republic Steel Corp., Canton, O.

Bertossa—Air conditioning systems. Jackson & Church Co., Saginaw, Mich.

Bifurcator—Fans. De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.

Bildrite—Insulation. Insulite Co., Minneapolis, Minn.

Binoc—Thermometers. Taylor Instrument Companies, Rochester, N. Y.

Birm—Water treatment. Research Products Corp., Madison, Wis.

Bison—Boilers. Farrar & Trefts, Buffalo, N. Y.

Bitugloss — Lacquers and enamels. Wailes Dove-Hermiston Corp., New York, N. Y.

Bloapco—Dust collectors. Blower Application Co., Milwaukee, Wis.

Blo-Matic — Stokers. Her-Born Engineering & Mfg. Co., Sandusky, O.

Blue Ribbon—Hangers or brackets, nipples, plates. Chicago Nipple Mfg. Co., Chicago, Ill.

Branford—Unions. Malleable Iron Fittings Co., Branford, Conn.

Brazarc—Electrodes. Universal Power Corp., Cleveland, O.

Brazo—Solder. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Breezo—Fans. Buffalo Forge Co., Buffalo, N. Y.

Bruce—Unit air coolers. Industrial Air Conditioning Co., Inc., Minneapolis, Minn.

Buckeye—Unit heaters. Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.

Bull Dog—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Bull Dog—Pipe, tubing. Phelps Dodge Copper Products Corp., New York, N. Y.

Bull Pup—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Burco—Welding apparatus. Burdett Mfg. Co., Chicago, Ill.

Burnham-Taco—Heaters. Burnham Boiler Corp., Irvington, N. Y.

C-E—Boilers. Combustion Engineering Co., New York, N. Y.

CE-Skelly—Stokers. Combustion Engineering Co., Inc., New York, N. Y.

C-H—Controllers and starters, heaters, relays, switches, valves. Cutler-Hammer, Inc., Milwaukee, Wis.

CJB—Bearings. Ahlberg Bearing Co., Chicago, Ill.

C & M—Hangers or brackets. Carty & Moore Engineering Co., Detroit, Mich.

C. N. I.—Pipe. Walworth Co., New York, N. Y.

C-U—Unit heaters. Surface Combustion Corp., Toledo, O.

C-X—Insulation. Celotex Corp., The, Chicago, Ill.

Cadillac—Meters. Central Station Steam Co., Detroit, Mich.

Cadman—Valves. Barrett Machine Co., N. S., Pittsburgh, Pa.

Cadwell—Air eliminators, valves. Beaton & Cadwell Mfg. Co., New Britain, Conn.

Calicel—Insulation. Celotex Corp., The, Chicago, Ill.

Calistone—Insulation. Celotex Corp., The, Chicago, Ill.

Calktite—Cement and compounds. U. S. Stonewear Co., New York, N. Y.

Calorider—Air washers, dehumidifiers, unit air conditioners. Research Corp., New York, N. Y.

Cameo—Radiation. Weil-McLain Co., Chicago, Ill.

Capacitrol — Temperature regulators. Wheelco Instruments Co., Chicago, Ill.

Capillary—Air washers, dehumidifiers. Air & Refrigeration Corp., New York, N. Y.

Capitol—Boilers, hangers or brackets, heaters, radiation, unit air conditioners. United States Radiator Corp., Detroit, Mich.

Capitol—Insulation. Standard Lime & Stone Co., Baltimore, Md.

Capitolaire — Unit air conditioners. United States Radiator Corp., Detroit, Mich.

Careycel—Insulation. Carey Co., Philip, Lockland, Cincinnati, O.

Careyduct—Ducts and duct fittings. Carey Co., Philip, Cincinnati, O.

Carrier-Brunswick—Compressors. Carrier Corp., Syracuse, N. Y.

Carton—Furnaces. International Heater Co., Utica, N. Y.

Cascade—Unit air conditioners. Todd Air Conditioning Co., Inc., Bonner Springs, Kans.

Casey-Hedges—Boilers. Combustion Engineering Co., Inc., New York, N. Y.

Castirnarc—Electrodes. Universal Power Corp., Cleveland, O.

Catawissa—Unions, valves. Central Forging Co., Catawissa, Pa.

Causul—Valves. Lunenheimer Co., Cincinnati, O.

Celoron—Couplings. Continental Diamond Fibre Co., Newark, Del.

Centrimax—Meters. Leeds & Northrup Co., Philadelphia, Pa.

Centripeller—Fans. Jordan & Co., Paul R., Indianapolis, Ind.

Century—Pipe. Keasbey & Mattison Co., Ambler, Pa.

Chaco—Cement and compounds, boiler and radiator sealing compounds. Desolvo Mfg. Co., Pittsburgh, Pa.

Champion—Wrenches. Greene, Tweed & Co., New York, N. Y.

Charavay—Propeller fans, unit heaters. Hartzell Propeller Fan Co., New York, N. Y.

Charm—Radiation. Thatcher Furnace Co., Newark, N. J.

Chief—Packing. Keasbey & Mattison Co., Ambler, Pa.

Chieftain — Compressors. Tecumseh Products Co., Tecumseh, Mich.

Chillblast—Unit air conditioners. Davis Engineering Corp., Elizabeth, N. J.

Chill-Vactor—Steam jet compressors, Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Chinook—Ferrous heating surface. Bayley Blower Co., Milwaukee, Wis.

Chinookfin—Non-ferrous heating surface. Bayley Blower Co., Milwaukee, Wis.

Chip Chaser—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Chromalox—Preheaters, unit heaters. Wiegand Co., Edwin L., Pittsburgh, Pa.

Chromeweld 4-6—Electrodes. Lincoln Electric Co., Cleveland, O.

Chronotherm—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Circle T—Switches. Trumbull Electric Co., Plainville, Conn.

CirCOOLator—Fans, ventilators. Viking Air Conditioning Corp., Cleveland, O.

Clarco—Unit heaters. Clarage Fan Co., Kalamazoo, Mich.

Clark-Sundh — Motor controls. Clark Controller Co., Cleveland, O.

Classic—Registers. Auer Register Co., Cleveland, O.

Cle-Bar—Heaters. Cleghorn Co., Boston, Mass.

Climate Changer—Unit air conditioners, unit air coolers. Trane Co., La Crosse, Wis.

Climate Master — Fan blades. Reed Unit-Fans, Inc., New Orleans, La.

Climax—Regulators. Kieley & Mueller, Inc., New York, N. Y.

Climax—Unions. Devlin Mfg. Co., Inc., Thos., Burlington, N. J.

Clinton — Grilles. Wickwire Spencer Steel Co., New York, N. Y.

Cocheco—Belting. Williams & Son, I. B., Dover, N. H.

Coey—Cooling towers. Research Corp., New York, N. Y.

Cog-Belt—Transmission drives. Dayton Rubber Mfg. Co., Dayton, O.

Colalloy—Alloy pipe, structural shapes, sheets, and tubing. Colonial Alloys Co., Specialties Div., Philadelphia, Pa.

Cold Stream—Unit air conditioners. Baker Ice Machine Co., Inc., Omaha, Nebr.

Colonial — Registers. Auer Register Co., Cleveland, O.

Com—Blowers. Wing Mfg. Co., L. J., New York, N. Y.

Combination—Steam traps. Wright-Austin Co., Detroit, Mich.

Combustioneer—Stokers. Steel Products Engineering Co., Springfield, O.

Comet—Fans, unit heaters. New York Blower Co., Chicago, Ill.

Comfortmaker—Air conditioning units. Joliet Heating Corp., Joliet, Ill.

Comfortrol—Effective temperature control. Friez & Sons, Julien P., Baltimore, Md.

Comfostat — Thermostats. Johnson Service Co., Milwaukee, Wis.

Compak—Valves. Commonwealth Brass Corp., Detroit, Mich.

Conco—Valves. Capitol Brass Division, Bohn Aluminum & Brass Corp., Detroit, Mich.

Condor—Belting, V belts, pipe. Manhattan Rubber Mfg. Div. of Raybestos Manhattan, Inc., Passaic, N. J.

Condo-Vac—Vacuum pumps. Chicago Pump Co., Chicago, Ill.

Con-Tac-Tor — Switches. Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

Contento—Boilers. National Radiator Corp., Johnstown, Pa.

Control-O-Gas—Regulators. Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.

Convectofin — Radiation. Commodore Heaters Corp., New York, N. Y.

Cool Wave — Air conditioning units. Philco Radio & Television Corp., Philadelphia, Pa.

Coolair—Fans. American Coolair Corp., Jacksonville, Fla.
Copes—Governors. Northern Equipment Co., Erie, Pa.
Copotite—Cement and compounds. National Boiler Improvement Co., Washington, D. C.
Cop-R-Loy — Sheets. Wheeling Steel Corp., Wheeling, W. Va.
Corto—Radiation. American Radiator Co., New York, N. Y.
Coxe — Boilers, stokers. Combustion Engineering Co., New York, N. Y.
Crescent — Burners. Caloroil Burner Corp., Hartford, Conn.
Crescent—Unions. Star Mfg. Co., Inc., Providence, R. I.
Cromaloy—Solder. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Crown—Cement and compounds. Colebrook & Sons, Inc., W. H., Syracuse, N. Y.
Crucibleweld — Electrodes. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Cub—Unions. Rhode Island Fittings Co., Hillsgrove, R. I.
Curtis—Regulators, traps, valves. d'Este Co., Julian, Charlestown, Mass.
Cycloidal—Air washers. Blower Application Co., Milwaukee, Wis.
D. F. C.—Combustion control systems. Denver Fire Clay Co., Denver, Colo.
D & H—Evaporative condensers, cooling and heating surfaces. Drayer & Hanson, Inc., Los Angeles, Cal.
Dart — Unions. Fairbanks Co., New York, N. Y.
Dean—Cleaners. Pierce Co., Wm. B., Buffalo, N. Y.
Decalorator—Steam jet compressors. Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Deflect-O-Grille—Grilles. U. S. Air Conditioning Corp., Minneapolis, Minn.
DeLuxe—Heaters. Grinnell Co., Inc., Providence, R. I.
Detroit — Traps. Nason Co., Detroit, Mich.
Detroit LoStoker—Stokers. Detroit Stoker Co., Detroit, Mich.
Detroit UniStoker — Stokers. Detroit Stoker Co., Detroit, Mich.
Dexter—Air separators. Leavitt Machine Co., Orange, Mass.
Dexter-Goebel — Systems, regulators. National Brass Co., Grand Rapids, Mich.
Dezert Kooler—Units. Utility Fan Corp., Los Angeles, Cal.
Diamond Fibre—Gaskets. Continental Diamond Fibre Co., Newark, Del.
Diamond H — Switches, thermostats. Hart Mfg. Co., Hartford, Conn.
Dickbelt—Belting, drives. Dick Co., Inc., R. & J., Passaic, N. J.
Dickrope—Belts, drives. Dick Co., Inc., R. & J., Passaic, N. J.
Difr-enshal-Vacm — Heating systems. Dunham Co., C. A., Chicago, Ill.
Differential — Thermostats. Johnson Service Co., Milwaukee, Wis.
Discfin—Cooling surface. General Refrigeration Corp., Beloit, Wis.
Disc-Loc—Grilles. Knowles Mushroom Ventilator Co., New York, N. Y.
Domic—Heaters. Central Radiator Co., New York, N. Y.
Dominion—Gaskets, packing. Darcoid Co., Inc., New York, N. Y.
Double Diamond—Hygrometers, recorders, psychrometers. H-B Instrument Co., Philadelphia, Pa.
Double Duty—Air filters. Independent Air Filter Co., Chicago, Ill.
Double-Seal—Copper tube fittings. Hays Mfg. Co., Erie, Pa.
Draftite—Cement, Keasbey & Mattison Co., Ambler, Pa.
Draftrite — Gages. Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Drainator — Traps. Coe Mfg. Co., Painesville, O.
Dry-Clone—Dust collectors. Sturtevant Mill Co., Boston, Mass.
Dry-paC—Covering. Ric-wiL Co., Cleveland, O.
Dual—Thermostats. Johnson Service Co., Milwaukee, Wis.
Dualsteel—Unions. Rockwood Sprinkler Co., Worcester, Mass.
Dunco—Relays, thermostats. Dunn Inc., Struthers, Philadelphia, Pa.
Duoflo—Pipe line strainers. Sheffler-Gross Co., Philadelphia, Pa.
Duo-Stat — Heating systems, thermostats. Johnson Service Co., Milwaukee, Wis.
Duplex—Machines. Bignall & Keeler Machine Wks., Edwardsville, Ill.
Duplex—Insulation. Keasbey & Mattison Co., Ambler, Pa.
DuraBilt—Registers. Auer Register Co., Cleveland, O.
DuraSpeed—Sprinkler heads. Grinnell Co., Inc., Providence, R. I.
Durimet—Sheets. Duriron Co., Inc., Dayton, O.
Duro—Valves. Lunkenheimer Co., Cincinnati, O.
Duroline — Pipe. National Tube Co., Pittsburgh, Pa.
Duronze—Silicon bronze rod. Bridgeport Brass Co., Bridgeport, Conn.
Dustoscope—Dust counters. Service to Industry, West Hartford, Conn.
Dustrol—Dust collectors. Falstrom Co., Passaic, N. J.
Dust-Stop—Air filters. Owens-Corning Fiberglas Corp., Toledo, O.
Dustube — Dust collectors. American Foundry Equipment Co., Mishawaka, Ind.
Dux-Sulation—Insulation. Wilson, Inc., Grant, Chicago, Ill.
EC & M—Motor controls. Electric Controller & Mfg. Co., Cleveland, O.
Eafco—Fittings. Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Easy-Flo—Solder. Handy & Harman, New York, N. Y.
Easyweld—Electrodes. Universal Power Corp., Cleveland, O.
Eclipse—Governors, regulators, traps, valves. Illinois Engineering Co., Chicago, Ill.
Economizer — Evaporative condensers. York Ice Machinery Corp., York, Pa.
Economy—Boilers, heaters. International Heater Co., Utica, N. Y.
Economy—Registers. Auer Register Co., Cleveland, O.
Economy—Regulators. Dockson Co., C. H., Detroit, Mich.
Economy — Stokers. Christensen Machine Co., Salt Lake City, Utah.
Economy—Traps. International Nutyp Tool Corp., Oswego, N. Y.
Economy—Unit ventilators. Arex Co., Chicago, Ill.
Electo-Wind—Ventilators. Allen Corp., Detroit, Mich.
Electrap—Pumps. Johnson Corp., Three Rivers, Mich.
Electra-Vac—Pumps. Johnson Corp., Three Rivers, Mich.
Electromode—Electric heaters. Electric Air Heater Co., Div., American Foundry Equipment Co., Mishawaka, Ind.
Electro-Sheet—Sheets. American Brass Co., Waterbury, Conn.
Electrozone—Ozone apparatus. Triox Engineering Co., St. Louis, Mo.
Electrunite—Stainless steel tubing. Steel and Tubes, Inc., Cleveland, O.
Elite—Registers. Auer Register Co., Cleveland, O.
Emco—Regulators. Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Emergency—Steam traps. Wright-Austin Co., Detroit, Mich.
Empire—Bolts and studs. Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Enco—Burners, regulators. Engineer Co., New York, N. Y.
Enduro—Packing. Keasbey & Mattison Co., Ambler, Pa.
Enduro—Pipe, sheets, tubing. Republic Steel Corp., Cleveland, O.
Enduro—Unions. Lockport Fittings Co., Inc., Lockport, N. Y.
Equalizing — Valves, Gorton Heating Corp., Cranford, N. J.
Equarad—Zone control radiator valve. Tallmadge & Co., Webster, East Orange, N. J.
Equatherm—Zone control thermostat. Tallmadge & Co., Webster, East Orange, N. J.
Equiflo—Valves. Grinnell Co., Inc., Providence, R. I.
Erwin—Dampers. Elgo Shutter & Mfg. Co., Detroit, Mich.
Eureka—Regulators, valves. Kieley & Mueller, Inc., New York, N. Y.
Eureka—Valves. Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Evactor—Pumps. Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Evalpak—Packing. Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Evco—Valves. Electric Valve Mfg. Co., Inc., New York, N. Y.
Evenaction—Valves. Taylor Instrument Companies, Rochester, N. Y.
Evenaire—Insulation. Plastergon Wall Board Co., Buffalo, N. Y.
Everdur—Pipe, sheets, tubing, welding rod. American Brass Co., Waterbury, Conn.
Excel—Unions. Lockport Fittings Co., Inc., Lockport, N. Y.
Excelso — Water heaters. American Radiator Co., New York, N. Y.
Exhaustair—Fans. New York Blower Co., Chicago, Ill.
Extra Dry Esotoo—Liquid sulphur dioxide. Virginia Smelting Co., West Norfolk, Va.
Eye-Hye—Gages. Reliance Gauge Column Co., Cleveland, O.
F & E—Stokers. Flynn & Emrich Co., Baltimore, Md.
FAB—Unions. Lockport Fittings Co., Inc., Lockport, N. Y.
FAB—Unions. Standard Union Co., Lockport, N. Y.
Fabrikated—Grilles, registers. Independent Register Co., Cleveland, O.
Falcon—Preheaters. Swoboda, Inc., H. O., New Brighton, Pa.
Fanmix—Burners. Coppus Engineering Corp., Worcester, Mass.
Fantom—Radiation. American Radiator Co., New York, N. Y.
Farragut—Packing. Darcoid Co., Inc., New York, N. Y.
Favorite—Wrenches. Greene, Tweed & Co., New York, N. Y.
Featherfin — Heating surface. Wing Mfg. Co., L. J., New York, N. Y.
Featherweight—Cement, insulation. Keasbey & Mattison Co., Ambler, Pa.
Featherweight—Unit heaters. Wing Mfg. Co., L. J., New York, N. Y.
Fel-Pro—Gaskets, packing. Felt Products Mfg. Co., Chicago, Ill.
Fero—Radiation. Burnham Boiler Corp., Irvington, N. Y.
Ferrenewo—Valves. Lunkenheimer Co., Cincinnati, O.
Ferroclad—Insulation. Truscon Steel Co., Youngstown, O.
Ferrocraft—Grilles. Tuttle & Bailey, Inc., New Britain, Conn.
Ferro-Therm — Insulation. American Flange & Mfg. Co., Inc., New York, N. Y.
Ferroweld—Electrodes. Lincoln Electric Co., Cleveland, O.
Fiberglas—Insulation. Owens-Corning Fiberglas Corp., Toledo, O.
Fields—Cement and compounds. Grinnell Co,, Inc., Providence, R. I.
Filmflo—Deaerators, separators. Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Filteraire—Window ventilator and filter units. Davies Air Filter Corp., New York, N. Y.
Findlay—Stokers. Bluffton Mfg. Co., The, Findlay, O.
Fire-Retardent — Insulation. Fir-Tex Insulating Board Co., St. Helens, Ore.
Fleetweld—Electrodes. Lincoln Electric Co., Cleveland, O.
Flexarc—Arc welders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Flexair—Grilles, registers. Tuttle & Bailey, Inc., New Britain, Conn.
Flexcord—Drives. Gates Rubber Co., Denver, Colo.

Flexeal—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Flexiwound—Gaskets. Azor Corp., Newark, N. J.

Flexodisc—Expansion joints. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Flextan—Packing. Chicago Belting Co., Chicago, Ill.

Flo-Klean—Filters, strainers. Cuno Engineering Corp., Meriden, Conn.

Flualyzer—Analyzers. Engelhard, Inc., Chas., Newark, N. J.

Flush Kleen—Ejectors. Chicago Pump Co., Chicago, Ill.

Forbes Syphonaire—Ventilators. Western Engineering & Mfg. Co., Los Angeles, Cal.

Forbes Tri-Peller—Fans. Western Engineering & Mfg. Co., Los Angeles, Cal.

Forcedraft—Unit air coolers. Fedders Mfg. Co., Inc., Buffalo, N. Y.

Force-Flo—Circulators, heaters, regulators, systems. Stevens-Root Co., Chicago, Ill.

Fosco—Heaters, ventilators. Schoedinger, F. O., Columbus, O.

Francke—Flexible couplings. Waldron Corp., John, New Brunswick, N. J.

Freeflo—Grilles. Trane Co., La Crosse, Wis.

Freeport—Oil burners. Holtum Mfg. Co., Freeport, Ill.

French Automatic—Oil burners. American Air Conditioning Corp., Sebastopol, Cal.

"Freon"—Refrigerant. Kinetic Chemicals, Inc., Wilmington, Del.

Fretz—Nipples. Devlin Mfg. Co., Inc., Thos., Burlington, N. J.

Frevent—Valves. Russell & Co., W. A., New York, N. Y.

Frigitower—Cooling towers. Schubert-Christy Corp., St. Louis, Mo.

Fulscope — Recorders, recorder-controllers, regulators. Taylor Instrument Companies, Rochester, N. Y.

fYBa—Motor operated valves. Barber-Colman Co., Rockford, Ill.

Fyr-Feeder—Stokers. American Coal Burner Co., Chicago, Ill.

G.B.C.—Circulators, pressure blowers, shutters. General Blower Co., Inc., Philadelphia, Pa.

G-M — Grilles, louvers and shutters, registers. Gillian Mfg. Co., Ferndale, Mich.

G-R—Cooling surface, heating surface. Griscom-Russell Co., New York, N. Y.

GTD—Pipe wrenches. Greenfield Tap & Die Corp., Greenfield, Mass.

Gallery — Grilles. Knowles Mushroom Ventilator Co., New York, N. Y.

Gardnerench—Tongs. Billings & Spencer Co., Hartford, Conn.

Gast—Filters, separators. Johnson Corp., Three Rivers, Mich.

Gasteam—Radiation. Clow, Jas. B. & Sons, Chicago, Ill.

Gauge-Rite—Gages. Anderson Products, Inc., Cambridge, Mass.

Geddes—Radiation. Fowler & Wolfe Radiator Co., Norristown, Pa.

Gemware — Hygrometers, psychrometers, thermometers. G. M. Mfg. Co., New York, N. Y.

Genasco—Insulation. Barber Co., Inc., Philadelphia, Pa.

Genuine Detroit—Gages, humidistats, operators, switches, thermostats, valves. Detroit Lubricator Co., Detroit, Mich.

Genuine Stillson—Wrenches. Walworth Co., New York, N. Y.

Geyser—Water heaters. Thatcher Furnace Co., Newark, N. J.

Giant—Radiator hangers or brackets. Western Hanger Co., San Francisco, Cal.

Giant—Unit heaters. Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.

Gilbarco—Burners, heaters, Gilbert & Barker Mfg. Co., Springfield, Mass.

Gilt Edge—Belting. Rhoads & Sons, J. E., Wilmington, Del.

Gimco—Insulation. General Insulating & Mfg. Co., St. Louis, Mo.

Gland-Pakt — Expansion joints. Yarnall-Waring Co., Philadelphia, Pa.

Gloco Red Band—Water heaters. Glore Sales Corp., Evins F., New York, N. Y.

Goetzerit—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Gohi—Sheets. Newport Rolling Mill Co., Newport, Ky.

Gothic—Radiation. Thatcher Furnace Co., Newark, N. J.

Graylite—Insulation. Insulite Co., Minneapolis, Minn.

Green—Stokers. Combustion Engineering Co., Inc., New York, N. Y.

Grid—Unit heaters. Unit Heater & Cooler Co., Wausau, Wis.

Grillometer—Direct reading air velocity meters. Detroit Air Meter Co., Detroit, Mich.

Gripbelts—Belts. Browning Mfg. Co., Inc., Ohio Valley Pulley Works, Div., Maysville, Ky.

Gun-Pakt—Expansion joints. Yarnall-Waring Co., Philadelphia, Pa.

Guthfan—Fans. Guth Co., Edwin F., St. Louis, Mo.

H-B—Boilers. Smith Co., H. B., Westfield, Mass.

H-B—Heaters. Handley Brown Heater Co., Jackson, Mich.

H & C—Dampers, grilles, registers. Hart & Cooley Mfg. Co., Chicago, Ill.

H-O-H—Compounds, water treatment. Haering & Co., Inc., D. W., Chicago, Ill.

Hager—Separators. Textite Corp., Chicago, Ill.

Hairbestos—Insulation. Wilson & Co., Chicago, Ill.

Hammerkraft—Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Handy — Valves. Lunkenheimer Co., Cincinnati, O.

Handy Andy—Vise stands. Western Wire Products Co., St. Louis, Mo.

Handy Flux—Solder. Handy & Harman, New York, N. Y.

Hardweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Haveg—Pipe, tanks. Continental Diamond Fibre Co., Newark, Del.

Hawks — Burners, humidifiers. Hugo Mfg. Co., West Duluth, Minn.

Heat Extractor—Boilers. National Radiator Corp., Johnstown, Pa.

Heat Fan — Unit heaters. Air Devices Corp., Meriden, Conn.

Health-Aire—Fans, heaters, unit coolers, ventilators. Johnson Fan & Blower Co., Chicago, Ill.

Heath—Manometers. Detroit Air Meter Co., Detroit, Mich.

Heatomat — Boilers, furnaces, heaters. Richmond Radiator Co., Gas Products Div., Uniontown, Pa.

Heavy Duty—Furnaces. International Heater Co., Utica, N. Y.

Helical—Tubing. Rome-Turney Radiator Co., Rome, N. Y.

Helmet Seal — Thermostats. National Regulator Div., Minneapolis-Honeywell Regulator Co., Chicago, Ill.

Hensel—Welders. Maple Valley Mfg. Co., Mapleton, Ia.

Herculoy—Sheets, tubing, welding rod. Revere Copper & Brass, Inc., New York, N. Y.

Hevikoat—Electrodes. Universal Power Corp., Cleveland, O.

High Dispersion—Heat transfer surface. Peerless of America, Inc., Chicago, Ill.

Highflex—Belting. Goodrich Co., B. F., Akron, O.

High-Temp—Packing. Keasbey & Mattison Co., Ambler, Pa.

Highway — Sheets. Apollo Steel Co., Apollo, Pa.

Hilger — Coils, refrigerating compressors, unit coolers, dehumidifiers, cooling towers, unit air conditioners. XL Refrigerating Co., Inc., Chicago, Ill.

Hi-Lo—Pumps. Yeomans Bros. Co., Chicago, Ill.

Hi-Speed — Brazing torches. Dockson Co., C. H., Detroit, Mich.

Hi-Spra — Spray nozzles. Schubert-Christy Corp., St. Louis, Mo.

Hitchings—Boilers. Burnham Boiler Corp., Irvington, N. Y.

Hi-Temp—Insulation. Carey Co., Philip, Lockland, Cincinnati, O.

Hi-Test — Pipe. Walworth Co., New York, N. Y.

Hitoncast—Grilles, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Hoffman Economy — Pumps. Hoffman Specialty Co., Inc., Waterbury, Conn.

Holby—Valves. Boiler Room Equipment, Inc., New York, N. Y.

Holdfast—Solder. American Brass Co., Waterbury, Conn.

Holt—Strainers. Rosedale Foundry & Machine Co., Pittsburgh, Pa.

Horton—Tanks. Chicago Bridge & Iron Co., Chicago, Ill.

Hot Shot—Pumps. Yeomans Bros. Co., Chicago, Ill.

Hovalco—Valves. Homestead Valve Mfg. Co., Coraopolis, Pa.

Huber—Stokers. Flynn & Emrich Co., Baltimore, Md.

Humidiguide—Hygrometers. Taylor Instrument Companies, Rochester, N. Y.

Humidostat—Humidistats. Johnson Service Co., Milwaukee, Wis.

Humi-Temps—Unit air coolers. Larkin Coils, Inc., Atlanta, Ga.

Humitherm—Unit air conditioners. Grinnell Co., Inc., Providence, R. I.

Humitrol — Humidistats. Mayflower-Lewis Corp., St. Paul, Minn.

Humphrey—Unit heaters. General Gas Light Co., Kalamazoo, Mich.

Hycarb—Electrodes. Universal Power Corp., Cleveland, O.

Hydramotor—Valves. General Controls Co., Glendale, Cal.

Hydro—Recorders. Bacharach Industrial Instrument Co., Pittsburgh, Pa.

Hydro—Packing. Keasbey & Mattison Co., Ambler, Pa.

Hydro—Valves. Kieley & Mueller, Inc., New York, N. Y.

Hydro-Clone—Dust collectors. Sturtevant Mill Co., Boston, Mass.

Hydron—Bellows, traps. Clifford Mfg. Co., Boston, Mass.

Hydrozone—Ionization and ozone apparatus, water treatment. American Hydrozone Co., Inc., New York, N. Y.

Hy-Duty — Fans. Schwitzer-Cummins Co., Indianapolis, Ind.

Hylo—Heating systems. Webster & Co., Warren, Camden, N. J.

Hy-Temp—Cement, insulation. Keasbey & Mattison Co., Ambler, Pa.

Hy-Test—Water heaters. Smith Co., H. B., Westfield, Mass.

Hytherstat—Combination humidity and temperature control. Friez & Sons, Julien P., Baltimore, Md.

Hytor—Pumps. Nash Engineering Co., South Norwalk, Conn.

I-R—Ingersoll-Rand, New York, N. Y.

Ice-O-Matic — Refrigerating compressors. Williams Oil-O-Matic Heating Corp., Bloomington, Ill.

Ideal—Blowers. Perfection Grate & Stoker Co., Springfield, Mass.

Ideal—Boilers, water heaters, valves. American Radiator Co., New York, N. Y.

Ideal—Ventilators. Tuttle & Bailey, Inc., New Britain, Conn.

Ideal—Traps. Nason Co., Detroit, Mich.

Immersatherm—Thermostats. Mercoid Corp., Chicago, Ill.

Impact—Spray nozzles. Cooling Tower Co., Inc., The, Div. of the Fluor Corp., Ltd., New York, N. Y.

Imperial—Boilers. National Radiator Corp., Johnstown, Pa.

In-Cel-Wood—Insulation. Cornell Wood Products Co., Chicago, Ill.

IngAclad—Stainless clad sheets. Ingersoll Steel & Disc Co., Chicago, Ill.

Ins-Lite—Insulation. Insulite Co., Minneapolis, Minn.

Instant—Heaters, preheaters. Johnson Corp., Three Rivers, Mich.

Instant—Water heaters. Sterling Engineering Co., Milwaukee, Wis.

Insulfil—Insulation. Refractory & Insulation Corp., New York, N. Y.

Insulroc—Insulation. Rock Products Co., Nashville, Tenn.

Insulwool—Insulation. General Insulating Products Co., Brooklyn, N. Y.

Ironton—Burners. Continental Stove Corp., Ironton, O.

J—Fittings, flanges, unions. Jenkins Mfg. Co., New York, N. Y.

J-M—Traps, Cryer Trap & Valve Co., Inc., New York, N. Y.

J. M. C.—Burners. Johnson Mfg. Co., Waterloo, Ia.

Jacknife—Hygrometers, psychrometers. Hill, E. Vernon, Chicago, Ill.

Janitrol—Burners, furnaces, heaters, unit air conditioners, unit air humidifiers. Surface Combustion Corp., Toledo, O.

Jarco—Unions. Jarecki Mfg. Co., Erie, Pa.

Jennings—Pumps, ejectors. Nash Engineering Co., South Norwalk, Conn.

Jewel—Packing. Keasbey & Mattison Co., Ambler, Pa.

Jointite — Insulation. Mundet Cork Corp., Brooklyn, N. Y.

Jones—Stokers. Riley Stoker Corp., Worcester, Mass.

Junior—Radiation. Weil-McLain Co., Chicago, Ill.

K—Fittings. Kuhns Brothers Co., Dayton, O.

K-S-V—Ventilators. Kernchen Co., Chicago, Ill.

Kable Kord—Belting. L. H. Gilmer Co., Philadelphia, Pa.

Kane—Boilers, gas burners. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Kant Klog—Spray nozzles. Howell Mfg. Co., Kansas City, Mo.

Kathabar—Dehumidifiers, unit air conditioners. Surface Combustion Corp., Toledo, O.

Kelly—Valves. National Metal Products Corp., Chicago, Ill.

Kentucky — Sheets. Newport Rolling Mill Co., Newport, Ky.

Key-Tite—Cement and compounds. Key Co., East St. Louis, Ill.

Kidskin—Packing. Darcoid Co., Inc., New York, N. Y.

King-clip—Valves. Lunkenheimer Co., Cincinnati, O.

Kleen Tube—Heaters. Adams Engineering Co., Chicago, Ill.

Kleenflo—Unit air filters. Air-Maze Corp., Cleveland, O.

Klinger—Valves. Klingerit, Inc., New York, N. Y.

Klixon—Temperature controls. Spencer Thermostat Co., Attleboro, Mass.

K-Master—Strainers, traps. Kaye & Macdonald, Inc., West Orange, N. J.

Knight—Weather strips. Barland Weatherstrip Material Co., Cleveland, O.

Kompak—Air filters. Independent Air Filter Co., Chicago, Ill.

Kooler-Aire—Commercial air conditioners. U. S. Air Conditioning Corp., Minneapolis, Minn.

Kopp-Sure-Travel—Joints. Kopperman & Sons, Joseph, Philadelphia, Pa.

Kramer—Condensers, heaters, surface, tubing, unit air conditioners. Trenton Auto Radiator Wks., Trenton, N. J.

Kromax — Packing. Watson - Stillman Co., Roselle, N. J.

Kroy—Unit heaters. Carrier Corp., Syracuse, N. Y.

Kwic-Lift—Hangers or brackets. Sterling Engineering Co., Milwaukee, Wis.

Kwik Konnectors—Fittings. Colonial Alloys Co., Specialties Div., Philadelphia, Pa.

L. A.—Motors. Louis Allis Co., Milwaukee, Wis.

L&N—Regulators. Leeds & Northrup Co., Philadelphia, Pa.

L-R—Couplings. Lovejoy Flexible Coupling Co., Chicago, Ill.

L. R. D.—Valves. Grinnell Co., Inc., Providence, R. I.

Laddi—Heaters. Johnson Co., S. T. Oakland, Cal.

Lamino—Insulation. Keasbey & Mattison Co., Ambler, Pa.

Lansdale—Heaters. Central Radiator Co., New York, N. Y.

Lavigne—Valves. Commonwealth Brass Corp., Detroit, Mich.

Lawson—Wrenches. U. S. Hame Co., Buffalo, N. Y.

Leader—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Lectrodryer—Dehumidifiers. Pittsburgh Lectrodryer Corp., Pittsburgh, Pa.

Lectro Shear—Shears. Black & Decker Mfg. Co., Towson, Md.

Levolometer — Gages. Liquidometer Corp., Long Island City, N. Y.

Lima—Stokers. Carnes, Inc., John R., Lima, O.

Limit-Load—Centrifugal fans. Buffalo Forge Co., Buffalo, N. Y.

Limpet—Insulation. Keasbey & Mattison Co., Ambler, Pa.

Linc-Weld — Motors. Lincoln Electric Co., Cleveland, O.

Lipman—Compressors, heat exchangers, cooling surface, unit air conditioners. General Refrigeration Corp., Beloit, Wis.

Liquivator—Pumps. Morehead Mfg. Co., Detroit, Mich.

Little Giant—Pipe extractors, vises, stocks and dies. Greenfield Tap & Die Corp., Greenfield, Mass.

Little Giant—Switches. Tork Clock Co., Inc., Mt. Vernon, N. Y.

Lo-Blast—Burners. National Machine Wks., Chicago, Ill.

Locarb—Electrodes. Universal Power Corp., Cleveland, O.

Lockaire—Insulation. Plastergon Wall Board Co., Buffalo, N. Y.

Logan—Radiation. Logansport Radiator Equipment Co., Logansport, Ind.

Lok - Joint—Insulation. Insulite Co., Minneapolis, Minn.

Longrip—Pipe extractors. Ridge Tool Co., Elyria, O.

Lookout Heggie-Simplex — Boilers, water heaters. Lookout Boiler & Mfg. Co., Chattanooga, Tenn.

Lord Burnham — Boilers. Burnham Boiler Corp., Irvington, N. Y.

Lowcost—Boilers. Murray Iron Wks., Co., Burlington, Ia.

Low Temp—Insulation. Insulite Co., Minneapolis, Minn.

Lubricore—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Lumenite—Recorders, switches. Paragon Electric Co., Chicago, Ill.

Luminare—Electrodes. Universal Power Corp., Cleveland, O.

Lyonore—Sheets. Lyon, Conklin & Co., Inc., Baltimore, Md.

M. & E.—Refrigerating compressors. Merchant & Evans Co., Philadelphia, Pa.

M & M—Feeders, switches, valves. McDonnell & Miller, Chicago, Ill.

M & S—Gaskets, insulation. Mitchell & Smith, Inc., Detroit, Mich.

MIF — Couplings, fittings. Malleable Iron Fittings Co., Branford, Conn.

MJL—Manometers, meters, recorders. Morey & Jones, Ltd., Los Angeles, Cal.

MKO—Boiler feeders. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

M/W and A/C Airmat—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Macheta — Fans. Aerovent Fan Co., Piqua, O.

Magic—Boilers. Joliet Heating Corp., Joliet, Ill.

Magic-Weather — Air washers, fans, unit air coolers. Ballantyne Co., Omaha, Nebr.

Magnesia—Insulation. Carey Co., Philip, Lockland, Cincinnati, O.

Majestic—Boilers. Ames Iron Wks., Div. of Pierce Butler Radiator Corp., Oswego, N. Y.

Manganweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Martell—Packing. France Packing Co., Tacony, Philadelphia, Pa.

Massachusetts — Fans, unit heaters, blower wheels, air washers. Bishop & Babcock Mfg. Co., Cleveland, O.

Master—Stokers. Muncie Gear Wks., Inc., Muncie, Ind.

Master—Thermostats. White Mfg. Co., St. Paul, Minn.

Master—Unions. Lockport Fittings Co., Inc., Lockport, N. Y.

Mayflower—Refrigerating compressors, cooling surface, unit air coolers. Hardy Mfg. Co., Inc., Dayton, O.

McDaniel—Floats, traps. Watson & McDaniel Co., Philadelphia, Pa.

McKee—Blowers, boilers, burners, feeders, pumps, regulators, tanks, torches, valves. Eclipse Fuel Engineering Co., Rockford, Ill.

McKeesport — Radiation. Columbia Radiator Co., McKeesport, Pa.

McKnight—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Measurrench — Wrenches. Williams & Co., J. H., New York, N. Y.

Mechanovent—Ventilators. New - York Blower Co., Chicago, Ill.

Mel-Rock—Ducts and duct fittings, humidifiers, units, ventilators, washers. Mellish & Murray Co., Chicago, Ill.

Menlo—Water heaters. Smith Co., H. B., Westfield, Mass.

Merkustat — Regulators, switches. Marsh Corp., Jas. P., Chicago, Ill.

Merrill Process — Heating systems. Parks-Cramer Co., Fitchburg, Mass.

Metermax—Combustion control systems. Leeds & Northrup Co., Philadelphia, Pa.

Metrotherm — Thermostats. General Controls Co., Glendale, Cal.

Micromax — Psychrometers, recorders, recorder-controllers, thermometers. Leeds & Northrup Co., Philadelphia, Pa.

Microstat—Thermostats. Friez & Sons, Julien P., Baltimore, Md.

Midget — Radiation. Utica Radiator Corp., Utica, N. Y.

Miles Jr.—Fans. Henry Furnace & Foundry Co., Cleveland, O.

Mills—Boilers. Smith Co., H. B., Westfield, Mass.

Milvaco — Air eliminators, feeders, strainers, traps, unions, valves. Milwaukee Valve Co., Milwaukee, Wis.

Milwaukee—Heaters. Blower Application Co., Milwaukee, Wis.

Milwaukee — Window ventilator and filter units. Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.

Milwaukee—Stokers. Automatic Stoker Corp., Milwaukee, Wis.

Minfelt—Cement, pipe covering. Mineral Felt Co., Toledo, O.

Mir-O-Meter—Combustion control systems. Bowser & Co., Inc., S. F., Fort Wayne, Ind.

Mirro-Matic—Heaters. Handley Brown Heater Co., Jackson, Mich.

Mirro-Shell—Heaters. Handley Brown Heater Co., Jackson, Mich.

MKayO—Boilers. Mears - Kane - Ofeldt, Inc., Philadelphia, Pa.

Mobilaire—Unit air coolers. Westinghouse Electric & Mfg. Co., East Springfield,, Mass.

Model "K" — Vapor heating systems. American Radiator Co., New York, N. Y.

Moderator—Heating system. Warren Webster Co., Camden, N. J.

Modulation—Valves. Webster & Co., Warren, Camden, N. J.

Modutrol — Heating systems. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Mohawk — Pipe. Cohoes Rolling Mill Co., Cohoes, N. Y.

Monarch—Furnaces. Forest City Foundries Co., Cleveland, O.

Moncrief—Furnaces, sheet metal pipe and fittings. Henry Furnace & Foundry Co., Cleveland, O.

Mono-Cast—Pipe. American Cast Iron Pipe Co., Birmingham, Ala.

Monoloy—Pipe. American Cast Iron Pipe Co., Birmingham, Ala.

Morflex — Flexible coupings. Morse Chain Co., Ithaca, N. Y.

Mortex—Cement, insulation. Mortell Co., J. W., Chicago, Ill.

Mosher—Separators. Barrett Machine Co., N. S., Pittsburgh, Pa.

Motoco—Recorders, thermometers. Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.

Motopump—Pumps. Yeomans Bros. Co., Chicago, Ill.

Motorstoker—Stokers. Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.

Mototurb—Ventilators. Uno Ventilator Co., Cliftondale, Mass.

Moyno—Pumps. Robbins & Myers, Inc., Springfield, O.

Multiclones—Dust collectors. Research Corp., New York, N. Y.

Multiflex—Valves. Wheeler Mfg. Co., C. H., Philadelphia, Pa.

Multi-Panel—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Multiseal—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Multitherm—Air Conditioning Units. Clarage Fan Co., Kalamazoo, Mich.

Multi-V—V Belts. Goodrich Co., B. F. Akron, O.

Multivane—Fans and blowers. B. F. Sturtevant Co., Boston, Mass.

Multi-Vane—Ventilators. Allen Corp., Detroit, Mich.

Multi-Wash—Dust collectors. Schneible Co., Claude B., Chicago, Ill.

Multy-Seal—Packing. Keasbey & Mattison Co., Ambler, Pa.

Murray—Radiation. American Radiator Co., New York, N. Y.

N-M-D — Valves. Lunkenheimer Co., Cincinnati, O.

National — Compressors. Janette Mfg. Co., Chicago, Ill.

National—Pumps. Austin-Mason Co., New York, N. Y.

National USS—Pipe, tubing. National Tube Co., Pittsburgh, Pa.

Naturzone—Insulation. Wilson & Co., Chicago, Ill.

Nelco—Insulation. Nelson Mfg. Co., B. F., Minneapolis, Minn.

Nelson—Stokers. Heating Assurance, Inc., Spokane, Wash.

Nemo—Insulating cement. Smith & Kanzler, Inc., Elizabeth, N. J.

New Cyclone—Dust collectors. Kirk & Blum Mfg. Co., Cincinnati, O.

New Kathode — Electrodes. Lincoln Electric Co., Cleveland, O.

New Lightweld — Electrodes. Lincoln Electric Co., Cleveland, O.

Newport—Humidistats. Johnson Tool Co., East Providence, R. I.

New Standard—Traps. Kieley & Mueller, Inc., New York, N. Y.

Niagara—Furnaces. Forest City Foundries Co., Cleveland, O.

Niagara — Meters, strainers. Buffalo Meter Co., Buffalo, N. Y.

Ni-Resist—Pipe. Walworth Co., New York, N. Y.

Non-clog — Sewage ejectors. Chicago Pump Co., Chicago, Ill.

Non-Clog—Pipe line strainers. Boylston Steam Specialty Co., Chicago, Ill.

Non-Con-Dux—Cement, covering, pipe. Wilson, Inc., Grant, Chicago, Ill.

Non-Flash—Brazing torches, welding and cutting apparatus. Torchweld Equipment Co., Chicago, Ill.

Non-Frost — Insulation. Keasbey & Mattison Co., Ambler, Pa.

Non-Sweat — Insulation. Keasbey & Mattison Co., Ambler, Pa.

Norblo—Dust collectors, fans, filters, washers. Northern Blower Co., Cleveland, O.

Nordstrom—Valves. Merco-Nordstrom Valve Co., Pittsburgh, Pa.

Northwind—Unit air coolers. Pleasantaire Corp., Washington, D. C.

Norwesco—Cement and compounds, boiler and radiator sealing compounds, lubricating oil. Atlas Chemical Co., Marietta, O.

No-Thread — Fittings. Dresser Mfg. Co., S. R., Bradford, Pa.

No-Ve-U—Door ventilators. Waterloo Register Co., Waterloo, Ia.

Novoid—Insulation. Cork Import Corp., New York, N. Y.

Novus — Boilers. National Radiator Corp., Johnstown, Pa.

Nu-Air—Fans. Meier Electric & Machine Co., Indianapolis, Ind.

Nu-Air—Ventilators. Milcor Steel Co., Milwaukee, Wis.

Nu-Alpina—Ventilators. Milcor Steel Co., Milwaukee, Wis.

Nu-Notch — Mushroom ventilators. Knowles Mushroom Ventilator Co., New York, N. Y.

OB—Valves. Ohio Brass Co., Mansfield, O.

OK—Motors. Marathon Electric Mfg. Corp., Wausau, Wis.

OK—Stocks and dies. Greenfield Tap & Die Corp., Greenfield, Mass.

Oblong—Grilles. Knowles Mushroom Ventilator Co., New York, N. Y.

OCECO—Pumps. Johnston & Jennings Co., Cleveland, O.

Ofeldt — Boilers, regulators. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Oil-O-Matic — Oil burners. Williams Oil-O-Matic Heating Corp., Bloomington, Ill.

Oriflex—Valves. Dunham Co., C. A., Chicago, Ill.

Oswego—Cutters, punches, wrenches. International Nutyp Tool Corp., Oswego, N. Y.

Oxford—Unions. Standard Union Co., New York, N. Y.

Oxweld—Welding rod, welding and cutting apparatus. Linde Air Products Co., The, New York, N. Y.

PDQC — Pipe machines. Bignall & Keeler Machine Wks., Edwardsville, Ill.

P & H—Motors. Harnischfeger Corp., Milwaukee, Wis.

P & H—Hansen—Arc Welders. Harnischfeger Corp., Milwaukee, Wis.

Pacific—Boilers. United States Radiator Corp., Detroit, Mich.

Packaged Steam—Boilers. PS Inc., Los Angeles, Cal.

Paintgrip — Sheets. American Rolling Mill Co., Middletown, O.

Palco—Packing. Greene, Tweed & Co., New York, N. Y.

Palco Wool—Insulation. Pacific Lumber Co., The, San Francisco, Cal.

Palmetto—Packing. Greene, Tweed & Co., New York, N. Y.

Par—Condensing units. Modern Equipment Corp., Defiance, O.

Paracoil — Heaters, heat exchangers. preheaters. Davis Engineering Corp., Elizabeth, N. J.

Parko—Psychrometers. Parks-Cramer Co., Fitchburg, Mass.

Paxtite—Packing. Watson-Stillman Co., Roselle, N. J.

Pebble—Registers. Auer Register Co., Cleveland, O.

Peerless—Dust collectors, humidifiers, air washers. New York Blower Co., Chicago, Ill.

Peerless—Pipe machines. Bignall & Keeler Machine Works, Edwardsville, Ill.

Penn-M-Co—Fittings. Penn Mfg. Corp. of Washington, Pa., Washington, Pa.

Perfection—Plates. Beaton & Cadwell Mfg. Co., New Britain, Conn.

Perfection—Regulators, valves. American District Steam Co., North Tonawanda, N. Y.

Permanite—Packing. Keasbey & Mattison Co., Ambler, Pa.

Permopad — Air filters. Independent Air Filter Co., Chicago, Ill.

Petro—Oil burners. Petroleum Heat & Power Co., Stamford, Conn.

Phoenix—Windows. Russell Insulation Co., F. C., Cleveland, O.

Pierce Firebox — Boilers. Ames Iron Works, Div. of Pierce Butler Radiator Corp., Oswego, N. Y.

Pipemaster—Wrenches. Erie Tool Wks., Erie, Pa.

Pitco—Unions. Pittsburgh Valve & Fittings Corp., Barberton, O.

Pittsburgh—Unit heaters. Automatic Gas Steam Radiator Co., Pittsburgh, Pa.

Pittsburgh—Water meters. Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Plastiseal — Cement and compounds. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Playford—Stokers. Rosedale Foundry & Machine Co., Pittsburgh, Pa.

Plexifin—Unit heaters. Bayley Blower Co., Milwaukee, Wis.

Plexiform—Fans. Bayley Blower Co., Milwaukee, Wis.

Plumrite—Pipe. Bridgeport Brass Co., Bridgeport, Conn.

Plymco—Air filters. Plymouth Cordage Co., N. Plymouth, Mass.; Anderson Products, Inc., Cambridge, Mass. National Sales Agents.

Popular Stillson—Wrenches. Trimont Mfg. Co., Boston, Mass.

Power—Belting. Rhodes & Sons, J. E., Wilmington, Del.

Power Boy—Pipe cutting and threading machines. Oster Mfg. Co., Cleveland, O.

Precipitron—Electrical air cleaners. Pangborn Corp., Hagerstown, Md.

Precipitron—Air cleaners, window ventilator and filter units. Westinghouse Electric & Mfg. Co., Cleveland, O.

Precision — Oil burners. Kleen-Heet, Inc., Chicago, Ill.

Premier—Boilers. Combustion Engineering Co., Inc., New-York, N. Y.

Premier — Boilers, heaters. National Radiator Corp., Johnstown, Pa.

Premier—Welding rod, electrodes. American Steel & Wire Co., Cleveland, O.

Presstico—Insulation. Presstite Engineering Co., St. Louis, Mo.

Prest-O-Lite—Leak detectors, torches. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Prest-O-Weld — Welding and cutting apparatus. Linde Air Products Co., The, New York, N. Y.

Probestos—Gasket. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Protectoglo—Systems. Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

Protectomotor—Air filters. Staynew Filter Corp., Rochester, N. Y.

Protectorelay — Relays. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Protectovent—Window ventilator and filter units. Staynew Filter Corp., Rochester, N. Y.

Psychrostat—Humidistats. Parks-Cramer Co., Fitchburg, Mass.

Pulling—Pumps. Columbus Steam Pump Works Co., Columbus, O.

Pulverzone—Stokers. American Coal Burner Co., Chicago, Ill.

Punkah—Louvers and shutters. Kelvin-White Co., Boston, Mass.

Purox—Electrodes, welding and cutting apparatus. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Pyrex—Glass pipe. Corning Glass Wks., Corning, N. Y.

Pyro—Thermometers. Pyrometer Instrument Co., New York, N. Y.

Pyrofelt—Insulation. Mineral Felt Co., Toledo, O.

Pyroment—Cement. Keasbey & Mattison Co., Ambler, Pa.

Q. F. R. — Pipe, tubing. Wheatland Tube Co., Philadelphia, Pa.

Q-T—Insulation. Celotex Corp., The, Chicago, Ill.

Quartzoid—Sprinkler heads. Grinnell Co., Inc., Providence, R. I.

Quilt—Insulation. Cabot, Inc., Samuel, Boston, Mass.

Quintuplet—Regulators. Maid-O-Mist, Inc., Chicago, Ill.

RB Pressure—Pressure blowers. Western Blower Co., Seattle, Wash.

R & G—Grilles, registers. Register & Grille Mfg. Co., Brooklyn, N. Y.

R-K—Combustion control systems, regulators. Ruggles-Klingemann Mfg. Co., Salem, Mass.

R & M—Fans, motors, pumps. Robbins & Myers, Inc., Springfield, O.

R-P Zeolite—Water treatment. Research Products Corp., Madison, Wis.

R. P. & C.—Valves. Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.

R-U-F—Fans. Reed Unit-Fans, Inc., New Orleans, La.

Radiant Heat—Burners. Burdett Mfg. Co., Chicago, Ill.

Radi-Ion—Ionization apparatus. Montgomery Bros., San Francisco, Cal.

Rainbow—Humidifiers. Sheer Co., H. M., Quincy, Ill.

Rainbow Mist—Nozzles. National Air Conditioning & Engineering Corp., Kansas City, Mo.

Ranarex—Gas analyzers. Permutit Co., New York, N. Y.

Rapiduction — Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Raybould—Couplings. Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Raydiant—Radiation. Weil-McLain Co., Chicago, Ill.

Reco—Condensers, exchangers, heaters, preheaters, tanks. Richmond Engineering Co., Richmond, Va.

Reco—Unit air conditioners. Refrigeration Economics Co., Inc., Canton, O.

Record-O-Stat — Recorder - Controllers, Johnson Service Co., Milwaukee, Wis.

Red — Controllers, ejectors, operators, regulators, switches, valves. Cooper Co., Clark, Philadelphia, Pa.

Red Band — Motors. Howell Electric Motors Co., Howell, Mich.

Red Devil—Cement. Pecora Paint Co., Philadelphia, Pa.

Red Diamond—Conduit, pipe. American District Steam Co., North Tonawanda, N. Y.

Red Dome—Heaters. Smith Co., H. B., Westfield, Mass.

Red Flash—Traps. Ellis Drier Co., Chicago, Ill.

Red Head—Tongs. Billings & Spencer Co., Hartford, Conn.

Red Head—Traps. Ellis Drier Co., Chicago, Ill.

Red-Reading-Mercury —Thermometers. Palmer Co., Cincinnati (Norwood), O.

Redsquare — Boilers. Utica Radiator Corp., Utica, N. Y.

Red Top — Humidistats, thermostats. H-B Instrument Co., Philadelphia, Pa.

Reed-Warren—Pumps. Reed Steam Equipment Co., Bridgeport, Conn.

Reliance—Packing. Chicago Belting Co., Chicago, Ill.

Reliance—Regulators. General Controls Co., Glendale, Cal.

Remco—Bases. Manley Products Corp., York, Pa.

Remote Re-Adjustable — Thermostats. Johnson Service Co., Milwaukee, Wis.

Renewo—Valves. Lunkenheimer Co., Cincinnati, O.

Renu-Vent—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Research—Belting. Graton & Knight Mfg. Co., Worcester, Mass.

Rex—Chain drives, couplings, nozzles, pillow blocks, pumps. Chain Belt Co., Milwaukee, Wis.

Rex-AC—Pillow Blocks, blowers, fans. Air Controls, Inc., Cleveland, O.

Rex-Airate—Roof ventilators, blower wheels. Air Controls, Inc., Cleveland, O.

Rexoil—Burners, heaters. Reif-Rexoil, Inc., Buffalo, N. Y.

Rexvane—Fans, unit heaters. Sturtevant Co., B. F., Boston, Mass.

Rex-Weld—Hose. Chicago Metal Hose Corp., Maywood, Ill.

Reynolds—Ducts and duct fittings, furnaces, heaters. Richmond Radiator Co., Gas Products Div., Uniontown, Pa.

Rhino — Calking compounds. Pecora Paint Co., Philadelphia, Pa.

Richvar—Boilers, radiation. Richmond Radiator Co., Gas Products Div., Uniontown, Pa.

Ridgid—Pipe machines, wrenches, cutters, vises. Ridge Tool Co., Elyria, O.

Rifco—Unions. Rhode Island Fittings Co., Hillsgrove, R. I.

Rihco—Humidifiers. Rhode Island Humidifier & Ventilating Co., Boston, Mass.

Rip-pl—Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Rockaway—Regulators, valves. Kieley & Mueller, Inc., New York, N. Y.

Rocktex—Insulation. Carey Co., Philip, Lockland, Cincinnati, O.

Rocop—Heaters. Rome-Turney Radiator Co., Rome, N. Y.

Roofvane—Ventilators. Sturtevant Co., B. F., Boston, Mass.

Roof-Vent—Ventilators. Reed Unit-Fans, Inc., New Orleans, La.

Rotameter—Flow meters. Schutte & Koerting Co., Philadelphia, Pa.

Rotary—Meters. American District Steam Co., North Tonawanda, N. Y.

Roto Blast—Furnaces. Moncrief Furnace Co., Atlanta, Ga.

Roto-Clone—Dust collectors. American Air Filter Co., Inc., Louisville, Ky.

Rotohood—Uno Ventilator Co., Cliftondale, Mass.

Rotojet—Spray nozzles. Binks Mfg. Co., Chicago, Ill.

Royal—Boilers, furnaces, water heaters. Hart & Crouse Corp., Utica, N. Y.

Ruberoid-Watson—Cement, insulation. Ruberoid Co., New York, N. Y.

Rubyfluid—Solder. Ruby Chemical Co., Columbus, O.

Runwell—Packing. Greene, Tweed & Co., New York, N. Y.

Rusco—Insulation. Russell Insulation Co., F. C., Cleveland, O.

Rustop — Boiler cleaning compounds, water treatment. Aquatic Chemical Laboratories, Inc., New York, N. Y.

Ryan—Burners, dampers, preheaters, valves. R-S Products Corp., Philadelphia, Pa.

SA—Valves. Lunkenheimer Co., Cincinnati, O.

S-N—Water heaters. Scott-Newcomb, Inc., St. Louis, Mo.

S & P—Burners, governors, preheaters, regulators, strainers, valves. Staples & Pfeiffer, Ltd., San Francisco, Cal.

St. John—Flow meters. American District Steam Co., North Tonawanda, N. Y.

Sal-Mo — Cement, insulation, packing, pipe. Sall Mountain Co., Chicago, Ill.

Sanidaire—Humidifiers. U. S. Air Conditioning Corp., Minneapolis, Minn.

Santrol—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Satincote — Insulation. Insulite Co., Minneapolis, Minn.

Saunders—Pipe cutters. Erie Tool Works, Erie, Pa.

Scobronze—Welding rod. Scovill Mfg. Co., Waterbury, Conn.

Scru-peller—Ejectors. Chicago Pump Co., Chicago, Ill.

Sea Lion—Packing. Chicago Belting Co., Chicago, Ill.

Sealdslab — Insulation. Insulite Co., Minneapolis, Minn.

Sealkote—Cement. Keasbey & Mattison Co., Ambler, Pa.

Seal-Less—Compressors. Westinghouse Electric & Mfg. Co., East Springfield, Mass.

Seismo-Dampers—Bases. Korfund Co., Long Island City, N. Y.

Selfvulc — Cement, insulation. Self-Vulcanizing Rubber Co., Inc., Chicago, Ill.

Sensitrol—Relays. Weston Electrical Instrument Corp., Newark, N. J.

Sesure—Gages. Yarnall-Waring Co., Philadelphia, Pa.

"78"—Traps. Webster & Co., Warren, Camden, N. J.

Shawco—Bends, joints, headers. Shaw Co., Benjamin F., Wilmington, Del.

Shelby—Tubing. National Tube Co., Pittsburgh, Pa.

Shield-Arc—Electrodes, arc welders. Lincoln Electric Co., Cleveland, O.

Shock Pads—Bases and pads. Butterworth, Jr., B. T., New Canaan, Conn.

Silent Air—Fans. Belanger Fan & Oven Co., Detroit, Mich.

Silent Floating—Bases. Buffalo Forge Co., Buffalo, N. Y.

Silentile—Insulation. Mineral Felt Co., Toledo, O.

Silentvane—Fans. Sturtevant Co., B. F., Boston, Mass.

Sil-Fos — Solder. Handy & Harman, New York, N. Y.

Silvercote—Insulation. Specialty Converters, Inc., Chicago, Ill.

Silverlink—Chain drives. Link-Belt Co., Chicago, Ill.

Silverseal—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Silverstreak—Chain drive. Link-Belt Co., Chicago, Ill.

Silvertop—Traps. Anderson Co., V. D., The, Cleveland, O.

Simplex—Gages. Viking Pump Co., Cedar Falls, Ia.

Simplex—Quadrants. Ohio Products Co., Cleveland, O.

Sirocco—Blowers, dust collectors, fans, grilles, unit air conditioners, unit air coolers, unit air humidifiers, air washers. American Blower Corp., Detroit, Mich.

Smoot—Combustion control systems, regulators. Republic Flow Meters Co., Chicago, Ill.

Smoothcote—Insulation. Insulite Co., Minneapolis, Minn.

Sodrin—Boiler and radiator sealing compound. Dole Valve Co., Chicago, Ill.

Softweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Sonistat—Gages. American Air Filter Co., Inc., Louisville, Ky.

Sono-O-Seal—Insulation. General Insulating Products Co., Brooklyn, N. Y.

Sovereign—Packing. Darcoid Co., Inc., New York, N. Y.

Spatter Film—Electrodes. Lincoln Electric Co., Cleveland, O.

Special '98—Regulators, valves. Kieley & Mueller, Inc., New York, N. Y.

Speedarc—Electrodes. Universal Power Corp., Cleveland, O.

Speed Heater—Unit heaters. Sturtevant Co., B. F., Boston, Mass.

Spider Web—Air filters. Wilson & Co., Chicago, Ill.

Spirodome — Spray nozzles. Cooling Tower Co., Inc., The, Div. of the Fluor Corp., Ltd., New York, N. Y.

Spirovane—Fans. Western Blower Co., Seattle, Wash.

Sporlan—Valves. Spoehrer-Lange Co., St. Louis, Mo.

Spraco—Nozzles, separators, strainers, washers. Spray Engineering Co., Somerville, Mass.

Spra-Rite—Nozzles. Binks Mfg. Co., Chicago, Ill.

Stabilflo—Valves. Foxboro Co., Foxboro, Mass.

Stable-Arc — Electrodes, arc welders. Lincoln Electric Co., Cleveland, O.

Stacon — Regulators, valves. Edison, Inc., Thomas A., Edison Electrical Controls Div., West Orange, N. J.

Sta-Cool—Heating and cooling surface. Star Radiator Co., Los Angeles, Cal.

Staidarc—Electrodes. Universal Power Corp., Cleveland, O.

Stainarc—Electrodes. Universal Power Corp., Cleveland, O.

Stainless—Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Stainweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Standard—Humidistats. Spencer Thermostat Co., Attleboro, Mass.

Standard—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Standard—Traps. Kieley & Mueller, Inc., New York, N. Y.

Stanite Metallo — Packing. Metallo Gasket Co., New Brunswick, N. J.

Star—Ventilators. Merchant & Evans Co., Philadelphia, Pa.

Stediflo—Pumps. Watson-Stillman Co., Roselle, N. J.

Steechan—Blinds. Standard Products Co., Detroit, Mich.

Sterilamp—Lamps. Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

Sterlco—Circulators, controls, eliminators, floats, gages, pumps, strainers, heating systems, traps, valves. Sterling Engineering Co., Milwaukee, Wis.

Stictite—Cement. Refractory & Insulation Corp., New York, N. Y.

Stil-Blade—Fans. Stilphen Engineering & Mfg. Co., C. A., Denver, Col.

Stokol—Stokers. Schwitzer - Cummins Co., Indianapolis, Ind.

Stowe—Stokers. Johnston & Jennings Co., Cleveland, O.

Streamaire—Unit heaters, radiation, cooling surface. Young Radiator Co., Racine, Wis.

Stream-Flow—Valves. Monat Valve & Forge Co., Inc., Pittsburgh, Pa.

Streamline—Ducts. Jacobs Co., B. & J., Cincinnati, O.

Streamline—Fittings. Mueller Brass Co., Port Huron, Mich.

Stronghold—Belting. Rhoads & Sons, J. E., Wilmington, Del.

Stud-Pak—Insulation. United States Mineral Wool Co., Chicago, Ill.

Sullarc—Electrodes. Universal Power Corp., Cleveland, O.

Super Air Screws — Fans. Marathon Electric Mfg. Corp., Wausau, Wis.

Super Alloy—Pipe. American Radiator Co., New York, N. Y.

Super Cold Fin—Cooling surface. Rempe Co., Chicago, Ill.

Super-deLavaud—Pipe. U. S. Pipe & Foundry Co., Burlington, N. J.

Superector—Wrenches. Williams & Co., J. H., New York, N. Y.

Super-Fan—Fans. Norwin Co., Freeport, Ill.

Superheat—Packing. Keasbey & Mattison Co., Ambler, Pa.

Superior—Wrenches. Williams & Co., J. H., New York, N. Y.

Superjustable—Wrenches. Williams & Co., J. H., New York, N. Y.

Superratchet—Ratchet wrenches. Williams & Co., J. H., New York, N. Y.

Superrench—Wrenches. Williams & Co., J. H., New York, N. Y.

Super-S—Gages. Klingerit, Inc., New York, N. Y.

Super Silvertop—Traps. Anderson Co., V. D., The, Cleveland, O.

Supersocket — Wrenches. Williams & Co., J. H., New York, N. Y.

Supertherm—Systems. Ross Engineering Corp., J. O., New York, N. Y.

Super-type — Unit heaters. Autovent Fan & Blower Co., Chicago, Ill.

Sure Seal — Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Sure Return — Condensation return pumps. Chicago Pump Co., Chicago, Ill.

Surevent—Valves. Gorton Heating Corp., Cranford, N. J.

Surlock—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Sylphon — Bellows, joints, operators, regulators, valves. Fulton Sylphon Co., Knoxville, Tenn.

Sylphon—Traps, valves. Webster & Co., Warren, Camden, N. J.

Synchro-Meter—Meters. Bailey Meter Co., Cleveland, O.

Synchrotax—Thermostats. Foxboro Co., Foxboro, Mass.

Synchrotie — Recorders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Syncretizer—Unit ventilators. Nesbitt, Inc., John J. & Buckeye Blower Co., Philadelphia, Pa.

Syncromaster—Pressure regulators. Mason-Neilan Regulator Co., Boston, Mass.

TE—Compressors. Janette Mfg. Co., Chicago, Ill.

T.T.—Smoke guns. Hill, E. Vernon, Chicago, Ill.

"T" Globe—Valves. Monat Valve & Forge Co., Inc., Pittsburgh, Pa.

Tabasco — Water heaters. Kewanee Boiler Corp., Kewanee, Ill.

Tag—Humidistats, hygrometers, manometers, meters, psychrometers, recorders, regulators, thermometers, traps, valves. Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.

Tank-O-Meter—Gages. Uehling Instrument Co., Paterson, N. J.

Tannate—Belting, packing. Rhoads & Sons, J. E., Wilmington, Del.

Tanseal — Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Teksag Colloid—Boiler compounds. American Teksag Products Co., Inc., Mount Vernon, N. Y.

Televisor—Gages. Schutte & Koerting Co., Philadelphia, Pa.

Teltru—Anemometers, gages. Hill, E. Vernon, Chicago, Ill.

Tem-Clock (Electric)—Time switches. Penn Electric Switch Co., Goshen, Ind.

Temlok—Insulation. Armstrong Cork Co., Lancaster, Pa.

Temperator — Unit air conditioners. Dunham Co., C. A., Chicago, Ill.

Tempryte — Windows. Truscon Steel Co., Youngstown, O.

Texaco — Lubricating oil. Texas Co., New York, N. Y.

Texrope—V - belt drives. Allis - Chalmers Mfg. Co., Milwaukee, Wis.

Tharco—Cement. Armstrong Co., Detriot, Mich.

Therhumiter—Thermometers. Parsons, John R., New York, N. Y.

Thermair—Furnaces, heaters. New York Blower Co., Chicago, Ill.

Thermax — Insulation. Celotex Corp., The, Chicago, Ill.

Thermidaire—Boilers, fans, furnaces, grilles, heaters, humidifiers, unit air conditioners. Campbell Heating Co., E. K., Kansas City, Mo.

Thermo—Expansion valves. Alco Valve Co., Inc., St Louis, Mo.

Thermofin — Radiation. Grinnell Co., Inc., Providence, R. I.

Thermoflex—Strainers, heating systems, traps, valves. Cashin Co., W. D., Boston, Mass.

Thermoguide — Thermometers. Taylor Instrument Companies, Rochester, N. Y.

Thermolier — Unit heaters, unit air coolers. Grinnell Co., Inc., Providence, R. I.

Thermopane—Windows. Libbey-Owens Ford Glass Co., Toledo, O.

Therm-o-tile—Conduit. Porter & Co., Inc., H. W., Newark, N. J.

Thermotrol—Valves. Sterling Engineering Co., Milwaukee, Wis.

Thermovent—Unit ventilators. Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.

Thor—Drills, pumps. Independent Pneumatic Tool Co., Chicago, Ill.

Thredolets—Fittings. Bonney Forge & Tool Wks., Allentown, Pa.

Three Point—Valves. Webster & Co., Warren, Camden, N. J.

Thrift—Water heaters. Surface Combustion Corp, Toledo, O.

Throway—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Ticone—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Tighton—Unions. Standard Union Co., New York, N. Y.

Timercoid — Time switches. Mercoid Corp., Chicago, Ill.

Timetrol (Manual) — Time switches. Penn Electric Switch Co., Goshen, Ind.

Tiny—Traps. Nason Co., Detroit, Mich.

Tiscot—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Titan—Traps. Nason Co., Detroit, Mich.

Titeseal—Cement and compounds. Radiator Specialty Co., Charlotte, N. C.

Tom Thumb—Pipe machines. Oster Mfg. Co., Cleveland, O.

Toncan—Pipe, sheets, tubing. Republic Steel Corp., Cleveland, O.

Toncanarc — Electrodes. Universal Power Corp., Cleveland, O.

Toolweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Torqometer—Torque indicating wrenches. Snap-On Tools Corp., Kenosha, Wis.

Transite — Pipe, refractories. Johns-Manville, New York, N. Y.

Transitorq—Speed reducers. New Departure Div., General Motors Corp., Bristol, Conn.

Trans-Lux—Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Transweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Trem-Bar—Insulation. United States Gypsum Co., Chicago, Ill.

Trimo—Cutters, vises, wrenches. Trimont Mfg. Co., Boston, Mass.

Trimo—Cutters. Erie Tool Works, Erie, Pa.

Trimo-Alloy—Wrenches. Trimont Mfg. Co., Boston, Mass.

Triple Duty—Boilers. Bass Foundry & Machine Co., Ft. Wayne, Ind.

Tri-Sil—Dampers, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Tritrol—Regulators, switches. Marsh Corp., Jas. P., Chicago, Ill.

Triumph—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Triumph—Pipe line filters. Adams Co., R. P., Buffalo, N. Y.

Triumph—Switches. Boston Auto Gage Co., Pittsfield, Mass.

Trojan—Boilers. Burnham Boiler Corp., Irvington, N. Y.

Truflex—Bi-metals. General Plate Co., Attleboro, Mass.

Try-Me—Regulators, strainers, valves. Tryco Products, Inc., Westfield, Mass.

Tubejet—Pumps. Wheeler Mfg. Co., C. H., Philadelphia, Pa.

Tuffernell—Cement, enamels. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Turbo—Air washers, dehumidifiers, spray nozzles. Bayley Blower Co., Milwaukee, Wis.

Turbo-Aquatherm — Water heaters. Dahlquist Mfg. Co., Inc., Boston, Mass.

Turbo Vane—Fans and blowers. B. F. Sturtevant Co., Boston, Mass.

Turret—Pumps. Yeomans Bros. Co., Chicago, Ill.

Tuway—Strainers. Wright-Austin Co., Detroit, Mich.

20th Century—Bearings. Roller Bearing Co. of America, Trenton, N. J.

Two Way—Dampers. Tuttle & Bailey, Inc., New Britain, Conn.

Tymit—Switches. Tork Clock Co., Inc., Mt. Vernon, N. Y.

UAC—Unit air conditioners. Burnham Boiler Corp., Irvington, N. Y.

U. F. S.—Clamps. Grinnell Co., Inc., Providence, R. I.

U. S.—Unions. United Superior Union Co., Inc., Brooklyn, N. Y.

USS—Sheets, structural shapes. Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

U. S. Airco—Air conditioning equipment. U. S. Air Conditioning Corp., Minneapolis, Minn.

U-Loy—Sheets. Republic Steel Corp., Cleveland, O.

Uniblade—Fans, pressure blowers. Autovent Fan & Blower Co., Chicago, Ill.

Unicool—Humidifiers, unit air conditioners, unit air coolers, unit air humidifiers, air washers. Betz Unit Air Cooler Co., Kansas City, Mo.

Uni-fin—Grilles, registers. Barber-Colman Co., Rockford, Ill.

Uni-flo—Grilles. Barber-Colman Co., Rockford, Ill.

Unitaire—Unit air conditioners. Westinghouse Electric & Mfg. Co., East Springfield, Mass.

Unitherm—Unit heaters. Clarage Fan Co., Kalamazoo, Mich.

Unitrol—Regulators. Marsh Tritrol Co., Chicago, Ill.

Universal—Air filters. Hugo Mfg. Co., West Duluth, Minn.

Universal—Hygrometers, psychrometers. Hill, E. Vernon, Chicago, Ill.

Universal — Regulators. Dockson Co., C. H., Detroit, Mich.

Upson—Bolts. Republic Steel Corp., Cleveland, O.

Utica—Radiation. International Heater Co., Utica, N. Y.

Utility—Packing. Keasbey & Mattison Co., Ambler, Pa.

Vacu-Draft — Blowers. Muncie Gear Wks., Inc., Muncie, Ind.

Valcalox—Damper regulators. Young Regulator Co., Cleveland, O.

Valpit—Unions. Pittsburgh Valve & Fittings Corp., Barberton, O.

Vari-Pitch—Speed changers. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Vaughan—Meters. Spray Engineering Co., Somerville, Mass.

Velvet—Cement. Keasbey & Mattison Co., Ambler, Pa.

Vento — Heating surface. American Radiator Co., New York, N. Y.

Vent-Rite—Air valves, air eliminators. Anderson Products, Inc., Cambridge, Mass.

Ventura—Fans. American Blower Corp., Detroit, Mich.

Venturafin — Unit heaters. American Blower Corp., Detroit, Mich.

Venturi-Flo — Air diffusers, Barber-Colman Co., Rockford, Ill.

Vercel—Insulation. Eagle-Picher Lead Co., Cincinnati, O.

Vibracork—Bases. Armstrong Cork Co., Lancaster, Pa.

Vibrafram—Insulation. Celotex Corp., The, Chicago, Ill.

Vibro-Dampers — Bases. Korfund Co., Long Island City, N. Y.

Vibro Insulators—Bases. Goodrich Co., B. F., Akron, O.

Victor — Steam traps. Wright-Austin Co., Detroit, Mich.

Victory—Burners. Caloroil Burner Corp., Hartford, Conn.

Vitalloy—Wrenches. Billings & Spencer Co., Hartford, Conn.

Vistand—Pipe vises, vise stands. Armstrong Mfg. Co., Bridgeport, Conn.

Vitra-Carlite--Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

V-Meth-L— Refrigerant. Virginia Smelting Co., West Norfolk, Va.

Vortex—Pumps. Lawrence Pump & Engine Co., Lawrence, Mass.

Vulcalock—Fittings, pipe, valves. Goodrich Co., B. F., Akron, O.

Vulcan—Benders, stands, tongs, vises. Williams & Co., J. H., New York, N. Y.

Vulcan—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Vulcan Boll-Weevil—Tongs. Williams & Co., J. H., New York, N. Y.

Vulcan Boll-Weevil Zephyr — Tongs. Williams & Co., J. H., New York, N. Y.

Vulcan Superior—Tongs, vises. Williams & Co., J. H., New York, N. Y.

Vulcan Supertong—Tongs. Williams & Co., J. H., New York, N. Y.

Vulco — Belts, drives. Gates Rubber Co., Denver, Col.

WHS—Couplings, drives, reducers. Smith, Inc., Winfield H., Springville, N. Y.

W. & McD.—Strainers, valves. Watson & McDaniel Co., Philadelphia, Pa.

W-S—Fittings. Watson-Stillman Co., Roselle, N. J.

Walco-Parmelee—Wrenches. Walworth Co., New York, N. Y.

Wallvane—Fans. Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Walseal — Fittings, valves. Walworth Co., New York, N. Y.

Waltham—Burners. d'Este Co., Julian, Charlestown, Mass.

Walton—Air filters. Research Products Corp., Madison, Wis.

Warco—Gages, valves. Russell & Co., W. A., New York, N. Y.

Ward-O-Vane—Fans. Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Water-Boy—Feeders. Maid-O-Mist, Inc., Chicago, Ill.

Waterfilm—Boilers. Koven & Bro., L. O., Jersey City, N. J.

Water-Ray-Trola — Heaters. Ray Oil Burner Co., San Francisco, Cal.

Way "Loctor"—Access panels. Walsh Spencer Co., Boston, Mass.

Wenco—Unit heaters. Warren Electric Appliance Co., Warren, Pa.

Wear-Proof—Pumps. Schneible Co., Claude B., Chicago, Ill.

Wearweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Weathermaker—Unit air conditioners. Carrier Corp., Syracuse, N. Y.

Weatherwood—Insulation. United States Gypsum Co., Chicago, Ill.

Webster—Air washers, nozzles. Strandwitz & Co., Inc., W. J., Camden,N. J.

Webster-Nesbitt—Unitheaters. Webster & Co., Warren, Camden, N. J.

Webster-Nesbitt — Unit heaters. Nesbitt, Inc., John J., Philadelphia, Pa.

Weldells—Welding fittings. Taylor Forge & Pipe Works, Chicago, Ill.

Weldfast—Welding rod. Revere Copper & Brass, Inc., New York, N. Y.

Weldolets—Fittings. Bonney Forge & Tool Works, Allentown, Pa.

Weldomatic — Arc welders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Weldotrol — Spot welders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Western Rotary—Ventilators. Western Engineering & Mfg. Co., Los Angeles, Cal.

Weyher — Circulators, heaters. Automatic Stoker Corp., Milwaukee, Wis.

Whirljet—Spray nozzles. Spraying Systems Co., Chicago, Ill.

White — Circulators, valves. Hoosick Engineering Co., Inc., Hoosick Falls, N. Y.

Wichita—Condensers, cooling towers. Motor Equipment Co., Wichita, Kans.

Wilco—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Williams-Hager — Valves. Williams Gauge Co., Pittsburgh, Pa.

Willie Williams — Pipe cutting and threading machines. Oster Mfg. Co., Cleveland, O.

Windowstat—Condensation control. Friez & Sons, Julien P., Baltimore, Md.

Wind-O-Vent—Window ventilator and filter units. Reed Unit-Fans, Inc., New Orleans, La.

Wing-Scruplex—Fans. Wing Mfg. Co., L. J., New York, N. Y.

Winner—Registers. Auer Register Co., Cleveland, O.

Wintermaster—Unit air humidifiers. International Boiler Works, Co., East Stroudsburg, Pa.

Witch—Hangers, protectors. Carpenter & Paterson, Inc., East Boston, Mass.

Wolverine—Collectors, fans, ventilators, washers. Belanger Fan & Oven Co., Detroit, Mich.

Wonder—Benders. American Pipe Bending Machine Co., Inc., Boston, Mass.

X-L—Gaskets, packing. Excelsior Leather Washer Co., Rockford, Ill.

Xacto—Meters. Bowser & Co., Inc., S. F., Fort Wayne, Ind.

Xit—Ventilators. Iona Ventilator Co., Inc., Philadelphia, Pa.

Yager—Solder. Benson Co., Inc., Alex R., Hudson, N. Y.

Yarway — Expansion joints, nozzles, traps, valves. Yarnall-Waring Co., Philadelphia, Pa.

Yellow-Jacket—Boilers. Joliet Heating Corp., Joliet, Ill.

Yorkaire—Unit air coolers. York Ice Machinery Corp., York, Pa.

York-Lalor—Oil burners, valves. York Oil Burner Co., Inc., York, Pa.

Zincgrip—Sheets. American Rolling Mill Co., Middletown, O.

DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS

PART 3—MANUFACTURERS' ADDRESSES

A

Accurate Mfg. Works, 2336-38 Milwaukee Ave., Chicago, Ill.
Ace Engineering Co., 1735 W. 31st St., Chicago, Ill.
Acer & Whedon, Medina, N. Y.
Acheson Mfg. Co., Braddock P. O., Rankin, Pa.
Acme Asbestos Covering & Flooring Co., 218 N. Elizabeth St., Chicago, Ill.
Acme Heating & Ventilating Co., Inc., 4224 Lowe Ave., Chicago, Ill.
Acme Industries, Inc., Cor. Mechanic and Ganson Sts., Jackson, Mich.
Acme Tin Plate & Roofing Supply Co., 10th and York Sts., Philadelphia, Pa.
Acorn Refining Co., 8001 Franklin Ave., Cleveland, O.
Adam Electric Co., Frank, 3650 Windsor St., St. Louis, Mo.
Adams Engineering Co., 230 E. Ohio St., Chicago, Ill.
Adams Mfg. Co., J. D., 217 S. Belmont Ave., Indianapolis, Ind.
Adams Co., R. P., 220 Delaware Ave., Buffalo, N. Y.
Advance Electric Co., 1260 W. Second St., Los Angeles, Cal.
Advance Fan & Blower Co., 3428 Bagley, Detroit, Mich.
Advanced Refrigerating Systems Co., 33rd and Arch Sts., Philadelphia, Pa.
Aeco Packing Products Co., 215 W. Illinois St., Chicago, Ill.
Aeolus Dickinson Co., 3320 S. Artesian Ave., Chicago, Ill.
●Aerofin Corp., 410 S. Geddes St., Syracuse, N. Y.
Aerovent Fan Co., 710 E. Ash St., Piqua, O.
Ahlberg Bearing Co., 3025 W. 47th St., Chicago, Ill.
Air Conditioning Products Co., 1230 18th St., Detroit, Mich.
Air Conditioning Supply Co., 4060 Superior Ave., Cleveland, O.
Air Control Products, Inc., 100 E. Broadway, Muskegon, Mich.
Air Controls, Inc., 9205 Detroit Ave., Cleveland, O.
Air & Refrigeration Corp., 11 W. 42nd St., New York, N. Y.
Aircraft Mfg. Co., 418 E. First St., Dayton, O.
Air Devices Corp., 70 Britannia St., Meriden, Conn.
Airgard Mfg. Co., 609 N. La Salle St., Chicago, Ill.
Airmaster Corp., 140 S. Dearborn St., Chicago, Ill.
●Air-Maze Corp., 5200 Harvard Ave., Cleveland, O.
Air-O-Cel Industries, Inc., 11616 Cloverdale Ave., Detroit, Mich.
Airo Supply Co., 2726 N. Ashland Ave., Chicago, Ill.
Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y.
●Airtemp, Div. of Chrysler Corp., Leo St., Dayton, O.
●Airtherm Mfg. Co., 1478 S. Vandeventer Ave., St. Louis, Mo.
Ajax Flexible Coupling Co., Westfield, N. Y.
Akrat Ventilator Co., 1717 Carroll Ave., Chicago, Ill.
Akron Metallic Gasket Co., 155 N. Union, Akron, O.
Akwa Heaters, Inc., 1955 Park Ave., New York, N. Y.
Alabama Pipe Co., Anniston, Ala.
Alco Products, Div. of American Locomotive Co., 30 Church St., New York, N. Y.
●Alco Valve Co., Inc., 2622 Big Bend Blvd., St. Louis, Mo.
Aldrich Pump Co., 4 Pine St., Allentown, Pa.
Alexander Bros., 406 N. 3rd, Philadelphia, Pa.
Alfol Insulation Co., Inc., 155 E. 44th St., New York, N. Y.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Allen Billmyre Corp., 136 Water St., South Norwalk, Conn.
Allen-Bradley Co., 1335 S. First St., Milwaukee, Wis.
Allen Corp., 9751 Erwin Ave., Detroit, Mich.
Allen-Sherman-Hoff Co., 225 S. 15th St., Philadelphia, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Allis Co., Louis, 427 E. Stewart St., Milwaukee, Wis.
All Metal Weatherstrip Co., 229 W. Illinois St., Chicago, Ill.
Alloy Steel Products Co., 1000 W. Elizabeth Ave., Linden, N. J.
Allpax Co., Inc., Mamaroneck, N. Y.
Alton Mineral Wool Insulation Co., P. O. Box 268, Alton, Ill.
Aluminum Aircell Insulation Co., Curtis Bldg., Detroit, Mich.
Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh, Pa.
American Air Conditioning Corp., P. O. Box 29, Sebastopol, Calif.
American Air Filter Co., Inc., 107 Central Ave., Louisville, Ky.
American Blower Corp., 6000 Russell St., Detroit, Mich.
American Bosch Corp., 3664 Main St., Springfield, Mass.
●American Brass Co., 414 Meadow St., Waterbury, Conn.
American Car & Foundry Co., 30 Church St., New York, N. Y.
American Cast Iron Pipe Co., 2930 N. 16th St., Birmingham, Ala.
American Chain & Cable Co., Inc., Page Steel & Wire Div., 929 Connecticut Ave., Bridgeport, Conn.
American Coal Burner Co., 155 E. Superior St., Chicago, Ill.
American Coolair Corp., 3604 Mayflower St., Jacksonville, Fla.
American Cooling Tower Co., 2710 McGee St., Kansas City, Mo.
●American District Steam Co., Bryant St., North Tonawanda, N. Y.
American District Telegraph Co., 155 E. 6th Ave., New York, N. Y.
American Flange & Mfg. Co., Inc., 1901 R. C. A. Bldg., New York, N. Y.
American Flexible Coupling Co., 1801 Pittsburgh Ave., Erie, Pa.
American Foundry Equipment Co., 619 Byrkit St., Mishawaka, Ind.
American Foundry & Furnace Co., Washington St. at McClun, Bloomington, Ill.
American Gas Products Co., 40 W. 40th St., New York, N. Y.
●American Hair & Felt Co., 1820 Merchandise Mart, Chicago, Ill.
American Hard Rubber Co., 11 Mercer St., New York, N. Y.
American Hydrozone Co., Inc., 10 E. 40th St., New York, N. Y.
American Injector Co., 1481-14th St., Detroit, Mich.
American Instrument Co., Silver Spring, Md.
American-Larson Ventilating Co., 1004 Keystone Bank Bldg., Pittsburgh, Pa.
American Locomotive Co., Diesel Engine Div., Auburn, N. Y.
American Manganese Bronze Co., Rhawn & Hegerman Sts., Philadelphia, Pa.
American-Marsh Pumps, Inc., 60 Capital Ave., N. E., Battle Creek, Mich.
American Metal Hose Branch, American Brass Co., 67 Jewelry St., Waterbury, Conn.
American Meter Co., Inc., 105 W. 40th St., New York, N. Y.
American Moistening Co., 260 W. Exchange St., Providence, R. I.
American Nickeloid Co., 113 Second St., Peru, Ill.
American Pipe Bending Machine Co., Inc., 37 Pearl St., Boston, Mass.
American Pipe Tool Co., 4856 W. Kinzie St., Chicago, Ill.
American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa.
●American Radiator Co., 40 W. 40th St., New York, N. Y.
●American Rolling Mill Co., 703 Curtis St., Middletown, O.
American Solder & Flux Co., Wayne Ave. and Berkley St., Philadelphia, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
American Teksag Products Co., Inc., 395 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
American Thermometer Co., 2907 Clark Ave., St. Louis, Mo.
American Warming & Ventilating Co., 1017-1021 Summit St., Toledo, O.
American Well Wks., 100 N. Broadway, Aurora, Ill.
American Zinc Products Co., Greencastle, Ind.
Ames Co., W. R., 150 Hooper St., San Francisco, Cal.
Ames Iron Works, Division of Pierce Butler Radiator Corp., Oswego, N. Y.
Amirton Co., 60 E. 42nd St., New York, N. Y.
Anchor Packing Co., 401 N. Broad St., Philadelphia, Pa.
Anchor Stove & Range Co., Third & Culbertson Sts., New Albany, Ind.
●Anderson Co., V. D., The, 1949 W. 96th St., Cleveland, O.
Anderson Engine & Foundry Co., Anderson, Ind.
Anderson Products, Inc., 17 Tudor St., Cambridge, Mass.
Andrews Lead Co., 26-36 Greenpoint Ave., Long Island City, N. Y.
Anemostat Corp. of America, 10 E. 39th St., New York, N. Y.
Anetsberger Bros., 3505 Elston Ave., Chicago, Ill.
Annis Air Filters, 1515 Gardena St., Glendale, Cal.
Ansul Chemical Co., Marinette, Wis.
Apollo Steel Co., 609 Warren Ave., Apollo, Pa.
Aquatic Chemical Laboratories, Inc., 118 E. 28th St., New York, N. Y.
Arex Co., 333 N. Michigan Ave., Chicago, Ill.
Armour Ammonia Works, 1355 W. 31st St., Chicago, Ill.
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Rd., Chicago, Ill.
Armstrong Bros. Tool Co., 317-357 N. Francisco Ave., Chicago, Ill.
Armstrong Co., Post Ave. and South St., Detroit, Mich.
●Armstrong Cork Co., 994 Concord St., Lancaster, Pa.
●Armstrong Machine Wks., 874 Maple St., Three Rivers, Mich.
Armstrong Mfg. Co., 303 Knowlton St., Bridgeport, Conn.
Arrow-Hart & Hegeman Elect. Co., 103 Hawthorn St., Hartford, Conn.
Ashton Valve Co., 161-1st St., Cambridge, Mass.
Askania Regulator Co., 1605 S. Michigan Ave., Chicago, Ill.
Atchison Revolving Door Co., Independence, Kans.
Athey Co., 6035-43 W. 65th St., Chicago, Ill.
Athol Machine & Foundry Co., 621-631 S. Kolmar Ave., Chicago, Ill.

● Advertisement in this issue. See Index to Advertisers, page 168.

Atlantic Metal Hose Co., Inc., 123 W. 64th St., New York, N. Y.
Atlas Chemical Co., Marietta, O.
Atlas Valve Co., Inc., 282 South St., Newark, N. J.
Auburn Foundry Inc., Stoker Div., Auburn, Ind.
Auditorium Conditioning Corp., 17 E. 42nd St., New York, N. Y.
●Auer Register Co., 3608 Payne Ave., Cleveland, O.
Aurora Pump Co., 619 Loucks St., Aurora, Ill.
Austin-Mason Co., 15 Park Row, New York, N. Y.
Au-Temp-Co Corp., 1 Park Ave., New York, N. Y.
Autoforce Ventilating System, 53 Devonshire St., Boston, Mass.
Automatic Gas Steam Radiator Co., 446 Brushton Ave., Pittsburgh, Pa.
●Automatic Products Co., 2460 N. 32nd St., Milwaukee, Wis.
Automatic Stoker Corp., 2427 W. North Ave., Milwaukee, Wis.
Automatic Switch Co., 154 Grand St., New York, N. Y.
Automatic Temperature Control Co., Inc., 34 E. Logan St., Philadelphia, Pa.
●Autovent Fan & Blower Co., 1811-27 N. Kostner Ave., Chicago, Ill.
Azor Corp., Newark, N. J.

B

Babcock & Wilcox Co., 85 Liberty St., New York, N. Y.
Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh, Pa.
Bache & Co., Semon, Greenwich & Morton Sts., New York, N. Y.
Badger & Sons Co., E. B., 75 Pitts St., Boston, Mass.
Badger Fire Extinguisher Co., 31 St. James Ave., Boston, Mass.
Bahnson Co., R. J., Reynolds Bldg., Winston-Salem, N. C.
Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, O.
●Baker Ice Machine Co., Inc., 1508 Evans St., Omaha, Nebr.
Baldor Electric Co., 4353 Duncan Ave., St. Louis, Mo.
Ballantyne Co., 219 N. 16th St., Omaha, Nebr.
Balloffet Dies and Nozzle Co., Inc., 45-51 Adams St., Guttenberg, N. J.
Barber Co., Inc., 16th & Arch Sts., Insurance Co. of North America Bldg., Philadelphia, Pa.
Barber-Colman Co., 225 Loomis St., Rockford, Ill.
Barber Gas Burner Co., 3704 Superior Ave., Cleveland, O.
Barco Mfg. Co., 1801 Winnemac Ave., Chicago, Ill.
Bardco Corp. of America, 6670 Lexington Ave., Los Angeles, Cal.
Barland Weatherstrip Material Co., 5600 Curtis Ave., Cleveland, O.
Barnes & Jones, Inc., 128 Brookside Ave., Jamaica Plain, Boston, Mass.
Barnes Co., W. F. & John, Rockford, Ill.
Barnes Tool Co., The, 150 Brewery St., New Haven, Conn.
Barrett, Haentjens & Co., Hazelton, Pa.
Barrett Machine Co., 912-916 Behan St., N. S., Pittsburgh, Pa.
Bartlett Hayward Co., 200 Scott St., Baltimore, Md.
Bass Foundry & Machine Co., 1602-1734 Hanna St., Ft. Wayne, Ind.
Bastian-Blessing Co., 240 E. Ontario St., Chicago, Ill.
Bausch & Lomb Optical Co., 635 St. Paul St., Rochester, N. Y.
Bayer Co., 4050 Park Ave., St. Louis, Mo.
Bayley Blower Co., 1817 S. 66th St., Milwaukee, Wis.
Beach-Russ Co., 60A Church St., New York, N. Y.
Beacon-Morris Corp., 702 Beacon St., Boston, Mass.
Bearings Co. of America, 501 Harrisburg Ave., Lancaster, Pa.
Beaton & Cadwell Mfg. Co., 185 Main St., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
Beatty Machine & Mfg. Co., 932 150th St., Hammond, Ind.
Beaver Pipe Tools, Inc., Keeney Ave., Warren, O.
Belanger Fan & Oven Co., 1230 18th St., Detroit, Mich.
Belco Exhaust Fan Mfg. Co., 3810 Olive St., St. Louis, Mo.
Belfield Co., H., 435 N. Broad St., Philadelphia, Pa.
Belknap Mfg. Co., 800 Union Ave., Bridgeport, Conn.
●Bell & Gossett Co., 3000 Wallace St., Chicago, Ill.
Belmont Packing & Rubber Co., Butler & Sepviva Sts., Philadelphia, Pa.
Belmont Smelting & Refining Wks., Inc., 349 Belmont Ave., Brooklyn, N. Y.
Bender Warrick Corp., 131 Pierce, Birmingham, Mich.
Bendix Products Corp., 401 Bendix Dr., South Bend, Ind.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Bennett Co., 1109 Harney St., Omaha, Nebr.
Benson Co., Inc., Alex R., 1040 Bay Rd., So. Hudson, N. Y.
Berger Mfg. Div., Republic Steel Corp., 1038 Belden Ave., Canton, O.
Berns Specialty Co., 1015 W. Lake St., Chicago, Ill.
Bernz Co., Inc., Otto, 280 Lyell Ave., Rochester, N. Y.
Berry, Jr., & Co., Inc., F. E., Everett, Mass.
Bertsch & Co., Inc., Church St., Cambridge City, Ind.
Best Register Co., 2005 W. Oklahoma Ave., Milwaukee, Wis.
Bethlehem Steel Co., Bethlehem, Pa.
Betz Air Conditioning Corp., 6 W. 9th St., Kansas City, Mo.
Bigelow Co., 92 River St., New Haven, Conn.
Biggs Boiler Wks. Co., Case Ave. and B. & O. R. R., E. Akron, O.
Bignall & Keeler Machine Wks., Edwardsville, Ill.
Billings & Spencer Co., 1 Laurel St., Hartford, Conn.
Binks Mfg. Co., 3114-40 Carroll Ave., Chicago, Ill.
Bird-Archer Co., 90 West St., New York, N. Y.
Bishop & Babcock Mfg. Co., 4901 Hamilton Ave., Cleveland, O.
Black & Decker Mfg. Co., Pennsylvania Ave., Towson, Md.
Blackhawk Mfg. Co., Broadway & The River, Milwaukee, Wis.
Blackmer Pump Co., 1809 Century Ave., S. W., Grand Rapids, Mich.
Blaisdell Compressor Co., 227 Fulton St., New York, N. Y.
Blaw-Knox Co., Blawnox, Pa.
Bliss Co., E. W., 1420 Hastings St., Toledo, O.
Blocksom & Co., E. 5th St., Michigan City, Ind.
Blood Brothers, Allegan, Mich.
Blower Application Co., 918 N. Fourth St., Milwaukee, Wis.
Blue Seal Chemical Co., 177 Westfield Ave., W., Roselle Park, N. J.
Bluffton Mfg. Co., The, 433 W. Main Cross St., Findlay, O.
Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill.
●Boester, Carl F., 220 Kingshighway, St. Louis, Mo.
Bohn Aluminum & Brass Corp., 2306 Franklin St., Detroit, Mich.
Boiler Room Equipment, Inc., 45 W. 45th St., New York, N. Y.
Bonney Forge & Tool Wks., Tilghman St. & Meadow St., Allentown, Pa.
Bordo Co., Inc., L. J., 115 New St., Glenside, Pa.
Bossert Corp., Inc., Lennox & Oswego Sts., Utica, N. Y.
Boston Auto Gage Co. 70 West St., Pittfield, Mass.
Boston Gear Works, Inc., North Quincy, Mass.
Boston Woven Hose & Rubber Co., Broadway, Cambridge, Mass.
Bostwick-Goodell Co., Norwalk, O.
Bowser & Co., Inc., S. F., 1302 E. Creighton Ave., Fort Wayne, Ind.
Boylston Steam Specialty Co., 116-122 W. Illinois St., Chicago, Ill.
Bremil Mfg. Co., Box 1030, Erie, Pa.
Bridgeport Brass Co., E. Main St., Bridgeport, Conn.
Bridgeport Thermostat Co., Connecticut Ave., Bridgeport, Conn.
Bristol Co., Platts Bridge, Waterbury, Conn.
Brooke Engineering Co., Inc., 173 W. Huntingdon St., Philadelphia, Pa.
Bros Boiler & Mfg. Co., Wm., Nicollet Island, Minneapolis, Minn.
Brown, Wm. P., 31 Sanford St., Springfield, Mass.
Brown-Brockmeyer Co., Inc., 1098 Smithville Rd., Dayton, O.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., 4534 Wayne Ave., Philadelphia, Pa.
Brownell Co., 300 N. Findlay St., Dayton, O.
Browning Mfg. Co., Inc., Ohio Valley Pulley Works, Div., Maysville, Ky.
●Brunner Mfg. Co., 1821 E. Broad St., Utica, N. Y.
Bryan Steam Corp., P. O. Box 337, Peru, Ind.
Bryant Heater Co., The, 17825 St. Clair Ave., Cleveland, O.
Bubar, Hudson H., 15 Park Row, New York, N. Y.
Buda Co., Harvey, Ill.
●Buffalo Forge Co., 171 Mortimer St., Buffalo, N. Y.
Buffalo Meter Co., 2917 Main St., Buffalo, N. Y.
●Buffalo Pumps, Inc., 171 Mortimer St., Buffalo, N. Y.
Buffalo Tank Co., Arlington, Staten Island, N. Y.
Builders Iron Foundry, 9 Codding St., Providence, R. I.
Bullard Co., The, 286 Canfield Ave., Bridgeport, Conn.
Bundy Steam Trap Co., Nashua, N. H.
Bundy Tubing Co., 10951 Hern, Detroit, Mich.
Burdett Mfg. Co., 19 N. Loomis St., Chicago, Ill.
Burgess Battery Co., 500 W. Huron St., Chicago, Ill.
Burhorn Co., Edwin, 1 Newark St., Hoboken, N. J.
Burke Electric Co., 1201 W. 12th St., Erie, Pa.
Burke Stoker & Mfg. Co., 921 W. 19th St., Chicago, Ill.
Burling Instrument Co., 241 Springfield Ave., Newark, N. J.
●Burnham Boiler Corp., Main St., Irvington, N. Y.
Burnham Stoker Co., 505 Columbia St., Vancouver, Wash.
Burnley Battery & Mfg. Co., Clay St., North East, Pa.
Burrowes Corp., 70 Free St., Portland, Me.
Burrows Mfg. Co., F. A., 1638 E. Market St., York, Pa.
Burt Mfg. Co., 635 Main St., Akron, O.
Bury Compressor Co., 18th & Cascade Sts., Erie, Pa.
Bush Mfg. Co., 100 Wellington St., Hartford, Conn.
Butler Mfg. Co., 13th & Eastern Ave., Kansas City, Mo.
Butterworth, B. T., Jr., New Canaan, Conn.
Byers Co., A. M., Clark Bldg., Pittsburgh, Pa.
Byron Jackson Co., 2150 E. Slauson Ave., Los Angeles, Cal.

C

Cabot, Inc., Samuel, 141 Milk St., Boston, Mass.
Calbar Paint & Varnish Co., 2612-26 N. Martha St., Philadelphia, Pa.
Caldwell, Farley M., 521 W. Berry St., Fort Wayne, Ind.
Caldwell Co., W. E., 2120 Brook St., Louisville, Ky.
Caloroil Burner Corp., 1477 Park St., Hartford, Conn.
Campbell Heating Co., E. K., 2445 Charlotte St., Kansas City, Mo.
Campbell Heating Co., 31st & Dean, Des Moines, Ia.
Canatsey Electric Mfg. Co., 620 Wyandotte St., Kansas City, Mo.
Canton Stoker Corp., 407 Andrews Place, S. W., Canton, O.
Capitol Brass Division, Bohn Aluminum & Brass Corp., 2306 Franklin St., Detroit, Mich.
Carbide & Carbon Chemicals Corp., 30 E. 42nd St., New York, N. Y.
Carbo-Oxygen Co., Benedum-Trees Bldg., Pittsburgh, Pa.
Carey Co., Philip, Wayne Ave., Lockland, Cincinnati, O.
Carling Turbine Blower Co., 25 St. John's Rd., Worcester, Mass.
Carnegie Illinois Steel Corp., Carnegie Bldg., Pittsburgh, Pa.
Carnes, Inc., John R., Greenlawn Ave. & Erie, R. R., Lima, O.
Carpenter & Paterson, Inc., 1190 Bennington St., East Boston, Mass.

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Carpenter Steel Co. Reading, Pa.
●Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.
Carty & Moore Engineering Co., 511 W. Larned St., Detroit, Mich.
Case & Son Mfg. Co., W. A., 33 Main St., Buffalo, N. Y.
●Cash Co. A. W., P. O. Box 135, Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Cashin Co., W. D., 69 A St., Boston, Mass.
Caterpillar Tractor Co., 600 W. Washington St., Peoria, Ill.
Cellufoam Corp., 6565 S. Lavergne Ave., Chicago, Ill.
Celotex Corp., The, 919 N. Michigan Ave., Chicago, Ill.
Central Brass Mfg. Co., 2950 E. 55th St., Cleveland, O.
Central Forging Co., Catawissa, Pa.
Central Foundry Co., 386 Fourth Ave., New York, N. Y.
Central Radiator Co., 420 Lexington Ave., New York, N. Y.
Central Station Steam Co., 2910 E. Woodbridge St., Detroit, Mich.
Central Tube Co., First National Bank Bldg., Pittsburgh, Pa.
Central Valve Mfg. Co., 255 E. 95th St., Chicago, Ill.
Centrifix Corp., 3029 Prospect Ave., Cleveland, O.
●Century Electric Co., 1806 Pine St., St. Louis, Mo.
Century Engineering Corp., 401-431 3rd St., S. E., Cedar Rapids, Ia.
Century Fan & Ventilator Co., 314 E. 39th St., New York, N. Y.
Certain-teed Products Corp., 100 E. 42nd St., New York, N. Y.
Certified Flexible Couplings, Inc., 122 E. 42nd St., New York, N. Y.
Chace Valve Co., W. M., 1606 Beard Ave., Detroit, Mich.
Chain Belt Co., 1644 W. Bruce, Milwaukee, Wis.
Chalmers Oil Burner Co., 1234 Central Ave., Minneapolis, Minn.
Chamberlain Metal Weather Strip Co., 1254 La Brosse St., Detroit, Mich.
Champion Blower & Forge Co., Harrisburg Ave. & Charlotte St., Lancaster, Pa.
Champion Machine & Forging Co., 3678 E. 78th St., Cleveland, O.
Chaplin-Fulton Mfg. Co., 28-40 Penn Ave., Pittsburgh, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Chase Brass & Copper Co., 236 Grand St., Waterbury, Conn.
Chelsea Fan & Blower Co., 370 W. 15th St., New York, N. Y.
Chelsea Metal Stamping Co., 95 8th Ave., New York, N. Y.
Cheney Co., Architects' Bldg., Philadelphia, Pa.
Chicago Air Filter Co., Joliet, Ill.
Chicago Belting Co., 113-125 N. Green St., Chicago, Ill.
Chicago Bridge & Iron Co., 37 W. Van Buren St., Chicago, Ill.
Chicago Die Casting Mfg. Co., 2512 W. Monroe St., Chicago, Ill.
Chicago Expansion Bolt Co., 126 S. Clinton St., Chicago, Ill.
●Chicago Metal Hose Corp., Maywood, Ill.
Chicago Metal Mfg. Co., 3724 S. Rockwell St., Chicago, Ill.
Chicago Nipple Mfg. Co., 1966 Southport Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Chicago Pump Co., 2336 Wolfram St., Chicago, Ill.
Chicago Specialty Mfg. Co., 332 N. Western Ave., Chicago, Ill.
Chicago Venetian Blind Co., 3105 W. 27th St., Chicago, Ill.
Chicago-Wilcox Mfg. Co., E. 77th St. & Anthony Ave., Chicago, Ill.
Chisholm Co., Allen E., 2640 E. Burnside St., Portland, Ore.
Christensen Machine Co., 1975 S. 2nd West St., Salt Lake City, Utah.
Cincinnati Shaper Co., Hopple, Garrard & Elam, Cincinnati, O.
Cincinnati Sheet Metal & Roofing Co., 230 E. Front St., Cincinnati, O.
Cissell Mfg. Co., W. M., 831 S. First St., Louisville, Ky.
●Clarage Fan Co., Porter St., Kalamazoo, Mich.
Clark Controller Co., 1146 E. 152 St., Cleveland, O.
Clauss Shear Co., Fremont, O.
Clayton & Lambert Mfg. Co., 11111 French Rd., Detroit, Mich.
Cleaver-Brooks Co., 3112 W. Center St., Milwaukee, Wis.
Clees Valve & Engineering Co., 90 West St., New York, N. Y.
Cleghorn Co., 86 Broad St., Boston, Mass.
Cleveland Punch & Shear Works Co., E. 40th and St. Clair Ave., Cleveland, O.
●Clifford Mfg. Co., 564 E. First St., Boston, Mass.
Clizbe Bros. Mfg. Co., Plymouth, Ind.
Clow & Sons, Jas. B., 201 N. Talman Ave., Chicago, Ill.
●Cochrane Corp., 3161 N. 17th St., Philadelphia, Pa.
Coe Mfg. Co., Bank St., Painesville, O.
Cohoes Rolling Mill Co., Canvass & Cortland Sts., Cohoes, N. Y.
Cole-Sullivan Engineering Co., 1316 Third St., N., Minneapolis, Minn.
Colebrook & Sons, Inc., W. H., 246 Walton St., Syracuse, N. Y.
Colonial Alloys Co., Specialties Div., E. Somerset, Trenton Ave. and Reading R. R., Philadelphia, Pa.
Columbia Mills, Inc., Saginaw, Mich.
Columbia Radiator Co., 3400 Walnut St., McKeesport, Pa.
Columbian Steel Tank Co., 1509 W. 12th St., Kansas City, Mo.
Columbus Heating & Ventilating Co., 182 N. Yale Ave., Columbus, O.
Columbus Metal Products Co., 767 N. 4th St., Columbus, O.
Columbus Steam Pump Wks. Co., 724 W. Gay St., Columbus, O.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., 200 Madison Ave., New York, N. Y.
Commodore Heaters Corp., 11 W. 42nd St., New York, N. Y.
Commonwealth Brass Corp., 5781-5835 Commonwealth Ave., Detroit, Mich.
Commonwealth Mfg. Corp., 4208 Davis Lane, Cincinnati, O.
Conco-Sampsel Stoker Corp., Mendota, Ill.
Conditionaire Unit Co., 2821 Montrose Ave., Chicago, Ill.
Conneaut Packing Co., Conneaut, O.
Connery Construction Co., 2nd & Luzerne Sts., Philadelphia, Pa.
Consolidated Air Conditioning Corp., 114 E. 32nd St., New York, N. Y.
Continental Diamond Fibre Co., Newark, Del.
Continental Electric Co., Inc., 323 Ferry St., Newark, N. J.
Continental Motors Corp., 12802 Jefferson Ave., E., Detroit, Mich.
Continental Rubber Wks., 1905 Liberty Blvd., Erie, Pa.
Continental Steel Corp., 1108 S. Main St., Kokomo, Ind.
Continental Stove Corp., Front & Walnut Sts., Ironton, O.
Cook Electric Co., 2700 Southport Ave., Chicago, Ill.
Cooling Tower Co., Inc., The, Div. of The Fluor Corp., Ltd., 15 John St., New York, N. Y.
Coolmaster Corp., 530 S. Dearborn St., Chicago, Ill.
Cooper Co., Clark, 159 Jefferson St., Philadelphia, Pa.
Cooper Sanitary Co., 3316 Race St., Philadelphia, Pa.
Copeland Refrigeration Corp., Sidney, O.
Coppus Engineering Corp., 374 Park Ave., Worcester, Mass.
●Cork Import Corp., 330 W. 42nd St., New York, N. Y.
Cork Insulation Co., Inc., 155 E. 44th St., New York, N. Y.
Corley Co., 629 Grove St., Jersey City, N. J.
Cornell Iron Wks., Inc., 36th Ave. & 13th St., Long Island City, N. Y.
Cornell Wood Products Co., 230 N. Michigan Ave., Chicago, Ill.
Corning Glass Works, Corning, N. Y.
Corozone Air Conditioning Corp., 1422 Euclid Ave., Cleveland, O.
●Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Crane Packing Co., 1801 Belle Plaine Ave., Chicago, Ill.
Crawford Co., 3220 W. 31st St., Chicago, Ill.
Crew-Equipment Co., Inc. 101 Park Ave. New York, N. Y.
Crise Elec. Mfg. Co., 316-20 S. Main St., Mt. Vernon, O.
Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.
Croll & Son, Jesse G., 2326-2606 Germantown Ave., Philadelphia, Pa.
Croll-Reynolds Engineering Co., Inc., 17 Johns St., New York, N. Y.
Cross Engineering Co., 160-178 Dundaff St., Carbondale, Pa.
Crown Die & Tool Co., 267 N. California Ave., Chicago, Ill.
Crown Iron Works, 1229 N. E. Tyler, Minneapolis, Minn.
Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y.
Cryer Trap & Valve Co., Inc., 366 Madison Ave., New York, N. Y.
Crystal Refrigerator Co., Fremont, Neb.
Cugley Incubator Co., Elkhart, Ind.
Cuno Engineering Corp., 80 S. Vine St., Meriden, Conn.
Curtis & Curtis Co., 450 Garden St., Bridgeport, Conn.
●Curtis Refrigerating Machine Co., 1950 Kienlen Ave., St. Louis, Mo.
Cutler-Hammer, Inc., N. 12th St. & W. St. Paul Ave., Milwaukee, Wis.

D

Dahlquist Mfg. Co., Inc., 40 W. 3rd St., Boston, Mass.
Dallas Engineering Co., Inc., 1115 Hall, Dallas, Tex.
Dampney Co. of America, 1243 River St., Hyde Park, Boston, Mass.
Darcoid Co., Inc., 200 Varick St., New York, N. Y.
Darling Valve & Mfg. Co., 701 Walnut St., Williamsport, Pa.
●Dart Mfg. Co., E. M., 134 Thurber Ave., Providence, R. I.
Davenport Mfg. Co., 301 W. College St., Meadville, Pa.
Davidson Co., M. T., 154 Nassau St., New York, N. Y.
Davidson Hy Duty Roof Fan Co., 213 California St., Newton, Mass.
Davies Air Filter Corp., 390 Fourth Ave., New York, N. Y.
Davis Engineering Corp., 1064 E. Grand St., Elizabeth, N. J.
Davis Regulator Co., 2546 S. Washtenaw Ave., Chicago, Ill.
Dayton Air Compressor Co., Dayton, O.
Dayton-Dowd Co., 115-17 York St., Quincy, Ill.
Dayton Rogers Mfg. Co., 2830 S. 13th Ave., Minneapolis, Minn.
Dayton Rubber Mfg. Co., 2345 W. Riverview Ave., Dayton, O.
Dean Bros Co., 323 W. 10th St., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Debevoise Co., 968 Grand Ave., Brooklyn, N. Y.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., 100-6th Ave., New York, N. Y.
Decatur Pump Co., 2750 Nelson Park Rd., Decatur, Ill.
Defender Automatic Regulator Co., 308 S. 8th St., St. Louis, Mo.
De Laval Steam Turbine Co., 300 Nottingham Way, Trenton, N. J.
De La Vergne Engine Co., Philadelphia, Pa.
Delco-Frigidaire Conditioning Div., General Motors Sales Corp., 1420 Wisconsin Blvd., Dayton, O.
●Delco Products Corp., 329 E. First St., Dayton, O.
Delta-Star Electric Co., 2400 Block, W. Fulton St., Chicago, Ill.
Delta Stoker Co., Foot of Commonwealth, North Chicago, Ill.
Deming Co., 14 Aetna St., Salem, O.
Denver Fire Clay Co., 2301 Blake St., Denver, Colo.
Desmond-Stephan Mfg. Co., Urbana, Ill.
Desolvo Mfg. Co., 33 Terminal Way, Pittsburgh, Pa.
d'Este Co., Julian, 6 Spice St., Charlestown, Mass.
Detroit Air Meter Co., Box 1473, Detroit, Mich.

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Detroit Brass & Malleable Works, 100 S. Campbell, Detroit, Mich.
Detroit Graphite Co., 550 12th St., Detroit, Mich.
●Detroit Lubricator Co., 5900 Trumbull Ave., Detroit, Mich.
Detroit Seamless Steel Tubes Co., c/o Grand River Station, Detroit, Mich.
●Detroit Stoker Co., Sales and Engineering Offices, General Motors Bldg., Detroit, Mich.; Works at Monroe, Mich.
●Detroit Stoker Co. of Canada, Ltd., Canada Bldg., Windsor, Ont.: Works at London. Ont.
DeVilbiss Co., The, 300 Phillips Ave., Toledo, O.
Devine Mfg. Co., Inc., J. P., 909 Shawnee Ave., Mt. Vernon, Ill.
Devlin Mfg. Co., Inc., Thomas, Burlington, N. J.
Diamond Chain & Mfg. Co., 400 Kentucky Ave., Indianapolis, Ind.
Diamond Expansion Bolt Co., 500 North Ave., Garwood, N. J.
Diamond Mfg. Co., 253 W. Eighth St., Wyoming, Pa.
Diamond Power Specialty Corp., 10340 Oakland, Detroit, Mich.
Dick Co., Inc., R. & J., 24-48 Sade St., Passaic, N. J.
Diehl Mfg. Co., Trumbull St., Elizabeth, N. J.
Dillon Steam Boiler Wks., Inc., D. M., Crocker St., Fitchburg, Mass.
Dissolene Corp., Hempstead, N. Y.
Dixon Crucible Co., Joseph, Wayne & Monmouth Sts., Jersey City, N. J.
Dockson Co., C. H., 3847 Wabash Ave., Detroit, Mich.
●Dockstader, S. E., 551 Munsey Bldg., Washington, D. C.
Dodge Mfg. Co., 500 S. Union St., Mishawaka, Ind.
Doheny Co., John J., 326 Lake St., Belmont, Mass.
Dole Valve Co., 1901-33 Carroll Ave., Chicago, Ill.
Domestic Engine & Pump Co., 50 Church St., New York, N. Y.
Douglass Pipe Machine Co., 707 Water St., St. Joseph, Mich.
Dow Chemical Co., Midland, Mich.
Downingtown Iron Wks., Wallace Ave., Downingtown, Pa.
Dracco Corp., 4057 E. 116th St., Cleveland, O.
Dravo Corp., Dravo Bldg., Pittsburgh, Pa.
Drayer & Hanson, Inc., 738 E. Pico Blvd., Los Angeles, Cal.
Dreis & Krump Mfg. Co., 7404 Loomis Blvd., Chicago, Ill.
Dresser Mfg. Co., S. R., 490 Fisher Ave., Bradford, Pa.
●Dunham Co., C. A., 450 E. Ohio St., Chicago, Ill.
Dunn, Inc., Struthers, 153 N. Juniper St., Philadelphia, Pa.
du Pont de Nemours & Co., E. I., R. & H. Chemicals Dept., Wilmington, Del.
du Pont de Nemours & Co., E. I., National Ammonia Div., Wilmington, Del.
du Pont de Nemours & Co., E. I., Fabrics & Finishes Dept., Wilmington, Del.
Durabla Mfg. Co., 114 Liberty St., New York, N. Y.
Durakool, Inc., 1010 N. Main St., Elkhart, Ind.
Duraloy Co., S. 26th St., Pittsburgh, Pa.
Duriron Co., Inc., 450 N. Findlay St., Dayton, O.
Duro Co., 537 Monument Ave., Dayton, O.
Dustlix Corp., 715 N. Van Buren St., Milwaukee, Wis.
Dwyer Mfg. Co., F. W., 565 W. Washington Blvd., Chicago, Ill.

E

Eagle-Picher Lead Co., Temple Bar Bldg., Cincinnati, O.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Eastman Kodak Co., Kodak Park, Rochester, N. Y.
Eclipse Aviation Corp., Div. of Bendix Aviation Corp., Bendix, N. J.
Eclipse Fuel Engineering Co., 707 S. Main St., Rockford, Ill.
Econocol Stoker Div. of Cotta Transmission Corp., 2340 11th St., Rockford, Ill.
Economy Electric Mfg. Co., 4606 W. 21st Pl., Chicago, Ill
Economy Equipment Co., 223 N. Wolcott Ave., Chicago, Ill.
Economy Pumps, Inc., 2522 W. Congress St., Chicago, Ill.
Eddy Stoker Corp., 4717 W. North Ave., Chicago, Ill.
Eddy Valve Co., Waterford, N. Y.
Edge Moor Iron Wks, 30 Rockefeller Plaza, New York, N. Y.
Edison, Inc., Thomas A., Edison Electrical Controls Div., Lakeside Ave., West Orange, N. J.
Edward Valve & Mfg. Co., 1200 W. 145th St., East Chicago, Ind.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Eisler Engineering Corp., 760 S. 13th St., Newark, N. J.
Electric Air Heater Co., Division of American Foundry Equipment Co., 555 Byrkit St., Mishawaka, Ind.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., Caledonia & Gillette Sts., La Crosse, Wis.
Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, O.
Electric Machinery Mfg. Co., 1331 Tyler St., N. E., Minneapolis, Minn.
Electric Valve Mfg. Co., Inc., 68 Murray St., New York, N. Y.
Electrimatic Corp., 2100 Indiana Ave., Chicago, Ill.
Electro Hot Heater Co., 4302 S. Tacoma Way, Tacoma, Wash.
Electroaire Corp., 1455-57 W. Congress St., Chicago, Ill.
Electrol, Inc., 934 Main Ave., Clifton, N. J.
Electrovent Fan & Mfg. Co., 812 W. Lake St., Chicago, Ill.
Elgin Softener Corp., Elgin, Ill.
Elgo Shutter & Mfg. Co., 634 W. Warren Ave., Detroit, Mich.
Elliott Co., Jeannette, Pa.
Ellis Drier Co., 2444 N. Crawford Ave., Chicago, Ill.
Ellison Draft Gage Co., 214 W. Kinzie St., Chicago, Ill.
Elsey Metal Specialties Co., 1535 Spruce St., Detroit, Mich.
Emerson Electric Mfg. Co., 1847 Washington Ave., St. Louis, Mo.
Endura Mfg. Corp., 45 N. 4th St., Quakertown, Pa.
Engelhard, Inc., Charles, 90 Chestnut St., Newark, N. J.
Engineer Co., 17 Battery Pl., New York, N. Y.
Enterprise Oil Burner Co., 2949 18th St., San Francisco, Cal.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Erie Bolt & Nut Co., Erie, Pa.
Erie City Iron Wks., 1450 East Ave., Erie, Pa.
Erie Tool Wks., 11th & French Sts., Erie, Pa.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Everlasting Valve Co., 49 Fisk St., Jersey City, N. J.
Excelsior Leather Washer Co., 700 Chestnut St., Rockford, Ill.
Excelsior Steel Furnace Co., 118 So. Clinton St., Chicago, Ill.
Excelsior Tool & Machine Co., 31st & Ridge Ave., East St. Louis, Ill.
Excelso Products Corp., 65 Clyde Ave., Buffalo, N. Y.

F

Fabling Co., W. D., 722 N. Broadway, Los Angeles, Cal.
Fafnir Bearing Co., 37 Booth St., New Britain, Conn.
●Fairbanks Co., 396 Lafayette St., New York, N. Y.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Fairmont Aluminum Co., Fairmont, W. Va.
Falstrom Co., Main Ave. & D. L. & W. R. R., Passaic, N. J.
Farley Sleeve & Hanger Co., 3748 E. 71st St., Cleveland, O.
Farquhar Co., Ltd., A. B., Duke St., York, Pa.
Farrar & Trefts, 9 Grimes St., Buffalo, N. Y.
Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y.
Federal-Mogul Corp., Detroit, Mich.
Fee and Stemwedel, Inc., 4949 N. Pulaski Rd., Chicago, Ill.
Felt Products Mfg. Co., 1514 Carroll Ave., Chicago, Ill.
Felters Co., Inc., 210 South St., Boston, Mass.
Ferguson & Lange Foundry Co., 1039 Willow St., Chicago, Ill.
Ferro-Nil Corp., 373 Fourth Ave., New York, N. Y.
Field Mfg. Co., 2328 Nelson St., Chicago, Ill.
Filtrine Mfg. Co., Inc., 53 Lexington Ave., Brooklyn, N. Y.
Firemood Machine Wks., Converse, Ind.
Firestone Tire & Rubber Co., S. Main St., Akron, O.
Fir-Tex Insulating Board Co., St. Helens, Ore.
Fisher Governor Co., 205 S. First Ave., Marshalltown, Ia.
Fitzgibbons Boiler Co., Inc., 101 Park Ave., New York, N. Y.
Flagg & Co., Inc., Stanley G., 1421 Chestnut St., Philadelphia, Pa.
Flemm Lead Co., Inc., Bradley Ave. & School St., Long Island City, N. Y.
Flexitallic Gasket Co., 8th & Bailey Sts., Camden, N. J.
Flexo Supply Co., Inc., 4221 Olive St., St. Louis, Mo.
Fluor Corp., Ltd., The, 909 E. 59th St., Los Angeles, Cal.
Flynn & Emrich Co., 301 N. Holliday St., Baltimore, Md.
Follansbee Bros. Co., 3rd & Liberty Aves., Pittsburgh, Pa.
Forest City Foundries Co., 2500 W. 27th St., Cleveland, O.
Forslund Pump & Machinery Co., 1717-19 Main St., Kansas City, Mo.
Foster Engineering Co., 109 Monroe St., Newark, N. J.
Foster Pump Wks., Inc., 46 Washington St., Brooklyn, N. Y.
Foster Wheeler Corp., 165 Broadway, New York, N. Y.
Fowler & Wolfe Radiator Co., Oak & Carson Sts., Norristown, Pa.
Foxboro Co., 106 Neponset Ave., Foxboro, Mass.
France Packing Co., 6512 Tacony St., Tacony, Philadelphia, Pa.
Frank Engineering Co., 11 Park Place, New York, N. Y.
Frederick Iron and Steel Co., E. 7th St., Frederick, Md.
Fresh-'nd Aire Co., 430 W. Erie St., Chicago, Ill.
Fretz-Moon Tube Co., Inc., Butler, Pa.
●Frick Co., Waynesboro, Pa.
Friez & Sons, Julien P., 4 N. Central Ave., Baltimore, Md.
Frost Mfg. Co., S. Henderson St., Galesburg, Ill.
Fuel Savers, Inc., 15th & Herr Sts., Harrisburg, Pa.
Fulflo Specialties Co., Inc., Blanchester, O.
Fuller Co., 124 Bridge St., Catasauqua, Pa.
●Fulton Sylphon Co., Knoxville, Tenn.

G

G. M. Mfg. Co., P. O. Box 151, Madison Square Sta., New York, N. Y.
●G & O Mfg. Co., 138 Winchester Ave., New Haven, Conn.
G. D. S. Machinery & Supply Co., Inc., 101 Walker St., New York, N. Y.
●Garden City Fan Co., 332 S. Michigan Ave., Chicago, Ill.
Gardiner Metal Co., 2514 W. 48th Pl., Chicago, Ill.
Gardner-Denver Co., Quincy, Ill.
Garlock Packing Co., 50 Main St., Palmyra, N. Y.
Gasweld Equipment Co., 625 W. Jackson Blvd., Chicago, Ill.
Gates Rubber Co., 999 S. Broadway, Denver, Colo.
Gatke Corp., 228 N. La Salle St., Chicago, Ill.
Gehl Bros. Mfg. Co., West Bend, Wis.
General Blower Co., Inc., 2402 Market St., Philadelphia, Pa.
General Bronze Corp., Hancock & Boulevard, Long Island City, N. Y.
General Ceramics Co., 71 W. 35th St., New York, N. Y.
General Controls Co., 700 W. Ivy St., Glendale, Cal.
General Electric Co., Air Conditioning Dept., 5 Lawrence St., Bloomfield, N. J.
General Electric Co., 1 River Rd., Schenectady, N. Y.
General Equipment Co., 315 S. Wichita, Wichita, Kan.
General Fittings Co., 123 Georgia Ave., Providence, R. I.
General Gas Light Co., 212 N. Park, Kalamazoo, Mich.
General Insulating & Mfg. Co., 705 Olive St., St. Louis, Mo.
General Insulating Products Co., 8821 15th Ave., Brooklyn, N. Y.
General Motors Corp., Detroit, Mich.
General Plate Co., 34 Forrest St., Attleboro, Mass.
General Refrigeration Corp., Shirland Ave., Beloit, Wis.
General Stokers, Inc., Broad St. Station Bldg., Philadelphia, Pa.

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Gerstein & Cooper Co., 1 W. Third St., South Boston, Mass.
Geuder, Paeschke & Frey Co., W. St. Paul Ave. & N. 15th St., Milwaukee, Wis.
Giant Grip Mfg. Co., 30 Osceola St., Oshkosh, Wis.
Giant Mfg. Co., South Ave., Council Bluffs, Ia.
Gilbert & Barker Mfg. Co., Cold Spring Ave., Springfield, Mass.
Gillian Mfg. Co., 650 E. Troy Ave., Ferndale, Mich.
Gilmer Company, L. H., 7230 Keystone St., Tacony, Philadelphia, Pa.
Glascock Bros. Mfg. Co., Muncie, Ind.
Gleason-Avery, Inc., 27 Clark St., Auburn, N. Y.
Globe Machine & Stamping Co., 1220 W. 76th St., Cleveland, O.
Globe Steel Tubes Co., 3839 W. Burnham St., Milwaukee, Wis.
Globe Ventilator Co., 205 River St., Troy, N. Y.
Glore Sales Corp., Evins F., 1949 Grand Central Terminal Bldg., New York, N. Y.
Goethel Co., Alfred C., 2337 N. 31st St., Milwaukee, Wis.
Goethel Sheet Metal Wks., Alfred, 1910 N. Killian Pl., Milwaukee, Wis.
Goetze Gasket & Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J.
Golden-Anderson Valve Specialty Co., Fulton Bldg., Pittsburgh, Pa.
Goodrich Co., B. F., 548 S. Main St. Akron, O.
Goodyear Tire & Rubber Co., E. Market St., Akron, O.
Gorton Heating Corp., Cranford, N. J.
Goulds Pumps, Inc., Fall St., Seneca Falls, N. Y.
Governair Corp., 605 W. Main St., Oklahoma City, Okla.
Grabler Mfg. Co., 6565 Broadway, Cleveland, O.
Graham Mfg. Co.. Inc., 220 Delaware Ave., Buffalo, N. Y.
Grand Rapids Blow Pipe & Dust Arrester Co., 525-28 Monroe Ave., Grand Rapids, Mich.
Granite City Steel Co., 20th & Madison Ave., Granite City, Ill.
Graton & Knight Mfg. Co., 356 Franklin St., Worcester, Mass.
Graver Tank & Mfg. Co., Inc., 4809 Todd Ave., East Chicago, Ind.
Greene, Tweed & Co., 109 Duane St., New York, N. Y.
Greenfield Tap & Die Corp., Sanderson St., Greenfield, Mass.
Grief, Edward C., 64 West End Ave., Bogota, N. J.
●Grinnell Co., Inc., 260 W. Exchange, Providence, R. I.
Griscom-Russell Co., 285 Madison Ave., New York, N. Y.
Guardian Utilities Co., 1023 E. 46th St., Chicago, Ill.
Guild & Garrison, Inc., 43 Keap St., Brooklyn, N. Y.
Gulf Oil Corp., 3800 Gulf Bldg., Pittsburgh, Pa.
Guth Co., Edwin F., 2615 Washington Blvd., St. Louis, Mo.

H

H-B Instrument Co., 2518 N. Broad St., Philadelphia, Pa.
Haering Co., Inc., D. W., 3408 W. Monroe St., Chicago, Ill.
Hagan Corp., 502 Bowman Bldg., Pittsburgh, Pa.
Haines & Co., William S., 12th & Buttonwood Sts., Philadelphia, Pa.
Hamburg Boiler Wks., Inc., Grand St., Hamburg, Pa.
Hamilton Rubber Mfg. Co., Mead St., Trenton, N. J.
Hammett Mfg. Co., 1907 Holmes St., Kansas City, Mo.
Hammond Brass Wks., Summer Blvd., Hammond, Mich.
Hampden Cornice Wks., Inc., 218-226 St. James Blvd., Springfield, Mass.
Handley Brown Heater Co., Jackson, Mich.
Handy & Harman, 82 Fulton St., New York, N. Y.
Hansen Mfg. Co., Inc., Princeton, Ind.
Hardinge Mfg. & Oil Burner Co., 1770 Berteau St., Chicago, Ill.
Hardy Mfg. Co., Inc., 100 Davis Ave., Dayton, O.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.
Harrington & King Perforating Co., 5655 Fillmore St., Chicago, Ill.
Harris & Co., Arthur, 210 N. Aberdeen St., Chicago, Ill.
Harris Calorific Co., 5501 Cass Ave., N. W., Cleveland, O.
Harrisburg Foundry & Machine Co., Inc., 7th & Curtin St., Harrisburg, Pa.
Harrisburg Steel Corp., 10th & Herr Sts., Harrisburg, Pa.
Harrison Radiator Div., Lockport, N. Y.
●Hart & Cooley Mfg. Co., 61 Kinzie St., Chicago, Ill.
Hart & Crouse Corp., 301 Turner St., Utica, N. Y.
Hart Mfg. Co., Hamilton St., Hartford, Conn.
Hartmann Co., Chas., 985 Dean St., Brooklyn, N. Y.
Hartzell Propeller Fan Co., P. O. Box 909, Roosevelt Ave., Piqua, O.
Harvey-Whipple, Inc., Springfield, Mass.
Hasco Valve & Machine Co., 1819 W. St. Paul Ave., Milwaukee, Wis.
Hastings Air Conditioning Co., Box 481, 615 W. South St., Hastings, Neb.
Hatch, George E., 10 E. 40th St., New York, N. Y.
Hays Corp., E. 8th St., Michigan City, Ind.
Hays Mfg. Co., 801 W 12th St., Erie, Pa.
Healy Ruff Co., 765 Hampden Ave., St. Paul, Minn.
Heartley Machine & Tool Co., 900-8 Summit Ave., Toledo, O.
Heating Assurance, Inc., 124 E. Augusta St., Spokane, Wash.
Hegeler Zinc Co., P. O. Box 599, Danville, Ill.
Heil Co., 3000 Montana St., Milwaukee, Wis.
Hendley & Whittemore, 6 Blackhawk Blvd., Beloit, Wis.
Hendrick Mfg. Co., 37 Dundaff St., Carbondale, Pa.
●Henry Furnace & Foundry Co., 3480 E. 49th St., Cleveland, O.
Henry Valve Co., 1019 N. Spaulding Ave., Chicago, Ill.
Herbert Boiler Co., Root & La Salle Sts., Chicago, Ill.
Her-Born Engineering & Mfg. Co., 212 Columbus Ave., Sandusky, O.
Hercules Chemical Co., Inc., 332 Canal St., New York, N. Y.
Hercules Float Wks., 200 Franklin St., Springfield, Mass.
Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.
Higgin Products, Inc., Newport, Ky.
Hill Diesel Engine Co., Lansing, Mich.
Hill, E. Vernon, 179 W. Washington St., Chicago, Ill.
Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y.
Hinde & Dauch Paper Co., Sandusky, O.
Hirschman Co., W. F., 220 Delaware Ave., Buffalo, N. Y.
Hobart Bros., Hobart Sq., Troy, O.
Hodge Boiler Wks., Summer St., East Boston, Mass.
Hodgman Mfg. Co., 135 Washington St., Taunton, Mass.
Hoffman Combustion Engineering Co., 710 Marquette Bldg., Detroit, Mich.
Hoffman Specialty Co.. Inc., Waterbury Natl. Bank Bldg., Waterbury, Conn.
Holcomb & Hoke Mfg. Co., 1545 Van Buren, Indianapolis, Ind.
Hollands Mfg. Co., Erie, Pa.
Hollup Corp., 3357 W. 47th Pl., Chicago, Ill.
Holsclaw Bros., Inc., Evansville, Ind.
Holtum Mfg. Co., Freeport, Ill.
●Holtzer-Cabot Electric Co., 125 Amory St., Boston, Mass.
Homestead Valve Mfg. Co., P. O. Box H, Coraopolis, Pa.
Hoosick Engineering Co., Inc., Branch No. 1, 23 Elm St., Hoosick Falls, N. Y.
Hoppes Mfg. Co., 850 N. Belmont Ave., Springfield, O.
Horton Mfg. Co., 3016 University Ave., S. E., Minneapolis, Minn.
Hotstream Heater Co., 8007 Grand Ave., Cleveland, O.
Hough Shade Corp., Janesville, Wis.
Houghton & Co., E. F., 240 W. Somerset St., Philadelphia, Pa.
Hound Packing Co., 4757 E. Ravenswood Ave., Chicago, Ill.
Howard Iron Wks. & Alberger Heater Co., 287 Chicago St., Buffalo, N. Y.
Howe Ice Machine Co., 2825 Montrose Ave., Chicago, Ill.
Howell Electric Motors Co., Howell, Mich.
Howell Mfg. Co., 1341 Montgall, Kansas City, Mo.
Hugo Mfg. Co., 49th Ave., W., & Superior St., West Duluth, Minn.
Hull Mfg. Co., Pennsylvania & Prospect Ave., Hagerstown, Md.
Hunt & Son, C. B., Salem, O.
Hussey & Co., C. G., 2850 Second Ave., Pittsburgh, Pa.
Huyette Co., Inc., Paul B., 401 N. Broad St., Philadelphia, Pa.
Hyatt Roller Bearing Co., Harrison, N. J.
Hynes Electric Heating Co., 210 Cherry St., Philadelphia, Pa.

I

Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, O.
Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.
●Illinois Engineering Co., 2035 S. Racine Ave., Chicago, Ill.
Illinois Iron & Bolt Co., 918 S. Michigan Ave., Chicago, Ill.
Illinois Malleable Iron Co., 1801 Diversey Ave., Chicago, Ill.
●Illinois Testing Laboratories, 419 N. LaSalle St., Chicago, Ill.
Illinois Zinc Co., 47th St. at Sacramento Ave., Chicago, Ill.
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
Imperial Electric Co., 64 Ira Ave., Akron, O.
●Independent Air Filter Co., 228 N. LaSalle St., Chicago, Ill.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
●Independent Register Co., 3747 E. 93rd St., Cleveland, O.
Indian Refining Co., 5 E. Market, Indianapolis, Ind.
Indian Trailer Corp., Koolroom Div., 2338 Indiana Ave., Chicago, Ill.
Industrial Air Conditioning Co.. Inc., 1317 Glenwood Ave., Minneapolis, Minn.
Industrial Apparatus Co., 720 N. Wabash Ave., Chicago, Ill.
Industrial Dryer Corp., 432 Fairfield St., Stamford, Conn.
Industrial Research, Lansdowne, Pa.
Ingersoll-Rand, 11 Broadway, New York, N. Y.
Ingersoll Steel & Disc Co., 310 S. Michigan Ave., Chicago, Ill.
Inland Mfg. Co., 1120 N. Cicero Ave., Chicago, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Inner-Tite Clamp Corp., Elizabeth, N. J.
Insto-Gas Corp., 1900 E. Jefferson, Detroit, Mich.
Insulite Co., 1100 Builders Exchange Bldg., Minneapolis, Minn.
Inter-Coastal Paint Corp., 15th St., and Southern R. R., East St. Louis. Ill.
International Boiler Works Co., East Stroudsburg, Pa.
International Engineering, Inc., 1145 Bolander Ave., Dayton, O.
International Engineering Wks., Inc., Box 71, Framingham, Mass.
International Heater Co., 101 Park Ave., Utica, N. Y.
International Moistening Co., 36 Exchange Pl., Providence, R. I.
International Nickel Co., 67 Wall St., New York, N. Y.
International Nutyp Tool Corp., 68 W. First St., Oswego, N. Y.
International Vermiculite Co., 11th & Stanford Ave., Springfield, Ill.
Iona Ventilator Co., Inc., 2821-29 W. Dauphin St., Philadelphia, Pa.
Iron Fireman Mfg. Co., 3170 W. 106th St., Cleveland, O.

● Advertisement in this issue. See Index to Advertisers, page 168.

J

Jackson & Church Co., 321 N. Hamilton Ave., Saginaw, Mich.
Jacobs Co., B. & J., 1729 John St., Cincinnati, O.
Jamar Co., Walker, 367 S. First Ave., E. Duluth, Minn.
Janette Mfg. Co., 556 W. Monroe St., Chicago, Ill.
Jareckl Mfg. Co., 1345 W. 12th St., Erie, Pa.
Jefferson Electric Co., 25th & Madison St., Bellwood, Ill.
Jefferson Union Co., Sales Office, 601 W. 26th St., New York, N. Y.; Factory, Lexington, Mass.
Jeffrey Mfg. Co., 956 N. Fourth St., Columbus, O.
●Jenkins Bros., 80 White St., New York, N. Y.
Jenkins Mfg. Co., 2 W. 45th St., New York, N. Y.
Jennison Co., 17 Putnam St., Fitchburg, Mass.
Johns-Manville, 22 E. 40th St., New York, N. Y.
Johnson Bronze Co., 460 S. Mill St., New Castle, Pa.
Johnson Co., S. T., 940 Arlington St., Oakland, Cal.; 401 N. Broad St., Philadelphia, Pa.
Johnson Corp., 830 Wood St., Three Rivers, Mich.
Johnson Fan & Blower Corp., 1320 W. Lake St., Chicago, Ill.
Johnson Mfg. Co., 10th & Sycamore, Waterloo, Ia.
Johnson Motors Corp., Galesburg, Ill.
●Johnson Service Co., 507 E. Michigan St., Milwaukee, Wis.
Johnson Tool Co., 65-67 Massasoit Ave., East Providence, R. I.
Johnston Bros., Inc., Ferrysburg, Mich.
Johnston Co., William W., 115 Bayard St., Dayton, O.
Johnston & Jennings Co., 877 Addison Rd., Cleveland, O.
Joliet Heating Corp., 1403 Herkimer St., Joliet, Ill.
Jones Foundry & Machine Co., W. A., 4401 W. Roosevelt Rd., Chicago, Ill.
Jones & Laughlin Steel Corp., Third & Ross St., Pittsburgh, Pa.
Jordan & Co., Paul R., 631 S. Delaware St., Indianapolis, Ind.
Justus Steam Trap Co., Napanoch, N. Y.

K

Kainer & Co., 761 W. Lexington, Chicago, Ill.
Kaiser Co., H. S., 3336 Franklin Blvd., Chicago, Ill.
Kane Mfg. Corp., Kane, Pa.
Kauffman Air Conditioning Corp., 4485 Olive St., St. Louis, Mo.
Kaye & MacDonald, Inc., 92 Franklin Ave., West Orange, N. J.
Keasbey & Mattison Co., Butler Ave., Ambler, Pa.
Keasbey Co., Robert A., 139-149 W. 19th St., New York, N. Y.
Keckley Co., O. C., 565 W. Washington Blvd., Chicago, Ill.
Keeler Co., E., 238 West St., Williamsport, Pa.
Keeney Mfg. Co., Main St., Newington, Conn.
Keldur Corp., 420 Lexington Ave., New York, N. Y.
Kellogg Co., M. W., The, 225 Broadway, New York, N. Y.
Kellogg Compressor & Mfg. Co., 97 Humboldt St., Rochester, N. Y.
Kelly-Koet, Covington, Ky.
Kelvin-White Co., 90 State St., Boston, Mass.
●Kelvinator Div., Nash-Kelvinator Corp., 14250 Plymouth Rd., Detroit, Mich.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kernchen Co., 103 E. Wacker Drive, Chicago, Ill.
Kerotest Mfg. Co., 2525 Liberty Ave., Pittsburgh, Pa.
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
●Kewanee Boiler Corp., Kewanee, Ill.
Key Co., 2700 McCasland, East St. Louis, Ill.
Kidder Mfg. Co., Inc., J. F., 426 Colchester Ave., Burlington, Vt.
Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y.
●Kinetic Chemicals, Inc., 10th & Market St., Wilmington, Del.
King-Seeley Corp., 302 Second St., Ann Arbor, Mich.
King Union Co., Inc., Hillsgrove, R. I.
King Ventilating Co., Box 178, Owatonna, Minn.
Kingsford Foundry & Machine Wks., 264 W. Second St., Oswego, N. Y.
Kinney Mfg. Co., 3529 Washington St., Boston, Mass.
Kirk & Blum Mfg. Co., 2838-52 Spring Grove Ave., Cincinnati, O.
Kisco Co., Inc., 4414-18 W. Papin St., St. Louis, Mo.
Kleenaire Corp., 409 Jefferson St., Stevens Point, Wis.
Kleen-Heet, Inc., 1823 Carroll Ave., Chicago, Ill.
Klingerit, Inc., 16-22 Hudson St., New York, N. Y.
Klipfel Mfg. Co., 2651 W. Harrison St., Chicago, Ill.
Knickerbocker Co., Jackson, Mich.
Knight, Maurice A., Kelly Ave., Akron, O.
Knowles Mushroom Ventilator Co., 41 N. Moore St., New York, N. Y.
Kol-Master Corp., Oregon, Ill.
Kopperman & Sons, Joseph, 316 New St., Philadelphia, Pa.
Korfund Co., 48-15 32nd Pl., Long Island City, N. Y.
Koven & Bro., L. O., 154 Ogden Ave., Jersey City, N. J.
Kraissl Co., Inc., The, 620 Main St., Hackensack, N. J.
Kuhlman Electric Co., Detroit Electric Furnace Div., Bay City, Mich.
Kuhns Bros. Co., 1800 McCall St., Dayton, O.

L

La Bour Pump Co., Inc., 1301 Sterling Ave., Elkhart, Ind.
Laclede Steel Co., Arcade Bldg., Rm. 1317, St. Louis, Mo.
Laclede Stoker Co., 4438 Hunt Ave., St. Louis, Mo.
La Crosse Tractor Co., La Crosse, Wis.
Lammert & Mann Co., 281 N. Wood St., Chicago, Ill.
Lamneck Products, Inc., 416-36 Dublin Ave., Columbus, O.
Lamson Co., Inc., Syracuse, N. Y.
Lamson & Sessions Co., 1971 W. 85th st., Cleveland, O.
Landis Machine Co., 5th & Church Sts., Waynesboro, Pa.
Lapp Insulator Co., Inc., Le Roy, N. Y.
Larkin Coils, Inc., 519 Fair St., S. E., Atlanta, Ga.
Larkin Packer Co., 6200 Maple Ave., St. Louis, Mo.
Lawler Automatic Controls, Inc., 453 N. MacQuesten Pkwy., Mount Vernon, N. Y.
Lawrence Pump & Engine Co., P. O. Box 70, Lawrence, Mass.
Lawson Co., F. H., Evans & Whately Sts., Cincinnati, O.
●Layne & Bowler, Inc., Memphis, Tenn.
Lead Lined Iron Pipe Co., 1 Broadway, Wakefield, Mass.
Leavitt Machine Co., East River St., Orange, Mass.
Lecourtenay Co., 5 Maine St., Newark, N. J.
Lee Heating Systems, 810 Union National Bank Bldg., Youngstown, O.
Lee & Son Co., Thomas, 128-132 W. Second St., Cincinnati, O.
Leeds & Northrup Co., 4970 Stenton Ave., Philadelphia, Pa.
Leffel & Co., James, 426 East St., Springfield, O.
Lehigh Fan & Blower Co., Front & Linden Sts., Allentown, Pa.
Leiman Bros., Inc., 146-181 Christie St., Newark, N. J.
Leland Electric Co., 1501 Webster St., Dayton, O.
Lennox Furnace Co., Marshalltown, Ia., and Syracuse, N. Y.
Leonard Valve Co., Elmwood Station, Providence, R. I.
Leslie Co., Valley Brook & Grant Aves., Lyndhurst, N. J.
Lewis & Co., Inc., Chas. S., 2207 Pine St., St. Louis, Mo.
Lewis & Co., Joseph E., 1218 Warner St., Baltimore, Md.
Libbey-Owens-Ford Glass Co., Box 919, Toledo, O.
Libert Machine Co., 324 N. Roosevelt St., Green Bay, Wis.
Lilie-Hoffman Cooling Towers, Inc., 4239 Duncan Ave., St. Louis, Mo.
Limbert & Co. Geo. B., 570 Fulton St., Chicago, Ill.
Lincoln Electric Co., 12818 Coit Rd., Cleveland, O.
●Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.
Lion Mfg. Corp., 2701-11 Belmont Ave., Chicago, Ill.
Liquid Carbonic Corp., 3100 S. Kedzie Ave., Chicago, Ill.
Liquidometer Corp., 37-15 Skillman Ave., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, 23-01 Borden Ave., Long Island City, N. Y.
Little Mfg. Co., M. S., 151 New Park Ave., Hartford, Conn.
Littleford Bros., 421 E. Pearl St., Cincinnati, O.
Locke Regulator Co., 76 North St., Salem, Mass.
Lockport Fittings Co., Inc., Lockport, N. Y.
Logan Engineering Co., Lawrence & Lamon Ave., Chicago, Ill.
Logansport Radiator Equipment Co., Logansport, Ind.
Lohman Inc., Wm. J., 62 Ninth Ave., New York, N. Y.
Lonergan Co., J. E., 211 Race St., Philadelphia, Pa.
Long Mfg. Co., Div., Borg-Warner Corp., 12501 Dequendie St., Detroit, Mich.
Lookout Boiler & Mfg. Co., Compress St. & Mfrs. Rd., Chattanooga, Tenn.
Lord Mfg. Co., 1633 W. 12th St., Erie, Pa.
Lovejoy Flexible Coupling Co., 5024 W. Lake St., Chicago, Ill.
Lowell Air Conditioning Corp., 2221 N. Broad St., Philadelphia, Pa.
Ludlow Valve Mfg. Co., Foot of Adams St., Troy, N. Y.
Lukens Steel Co., 308 S. First Ave., Coatesville, Pa.
LUL Products, Inc., 2235 Sisson St., Baltimore, Md.
Lumsden & Van Stone Co., 426 First St., South Boston, Mass.
Lunkenheimer Co., Waverly & Beekman Sts., Cincinnati, O.
Luzerne Rubber Co., Muirhead Ave., Trenton, N. J.
Lycoming Mfg. Co., Williamsport, Pa.
Lynchburg Foundry Co., Peoples Bank Bldg., Lynchburg, Va.
Lyon, Conklin & Co., Inc., McComas & Race Sts., Baltimore, Md.
Lytton Mfg. Corp., 102 First Ave., Franklin, Va.

M

Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J.
Macrae Inc., 554 Vanderbilt Ave., Brooklyn, N. Y.
Magirl Foundry & Furnace Wks., P. H., 413 E. Oakland Ave., Bloomington, Ill.
●Maid-O-Mist, Inc., 180 N. Wacker Dr., Chicago, Ill.
Malleable Iron Fittings Co., Branford, Conn.
Mallory Sales Co., 13904 Lincoln Ave., Dolton, Ill.
Manhattan Rubber Mfg., Div. of Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Manitowoc Boiler Wks., 16th & The River, Manitowoc, Wis.
Manley Products Corp., State & Hay Sts., York, Pa.
Manning, Maxwell & Moore, Inc., American Schaeffer & Budenberg Instrument Div., 11 Elias St., Bridgeport, Conn.
Manning, Maxwell & Moore, Inc., Hancock Valve Div., 11 Elias St., Bridgeport, Conn.
Manufacturers Fin Coil Co., 2505-7 S. Pulaski Rd., Chicago, Ill.
Manufacturers Machine Co., Railroad Ave., North Andover, Mass.
Maple Valley Mfg. Co., First St., Mapleton, Ia.
Marathon Electric Mfg. Corp., Plumer's Island, P. O. 440, Wausau, Wis.
Marathon Oil Co., Tulsa, Okla.
Marble-Card Electric Co., Gladstone, Mich.
Marion Machine, Foundry & Supply Co., P. O. Box 685, 3rd and Big Four Ry., Marion, Ind.
Mark & Co., Clayton, 20 N. Wacker Drive, Chicago, Ill.
Marley Co., 3001 Fairfax Rd., Kansas City, Kans.
Marlo Coil Co., 6135 Manchester Ave., St. Louis, Mo.
Marquette Mfg. Co., 401 Johnson St., Minneapolis, Minn.

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Marsh Corp., Jas. P., 2073 Southport Ave., Chicago, Ill.
Marsh Tritrol Co., 600 S. Michigan Ave., Chicago, Ill.
Marsh Valve Co., 4th St. & Brigham Rd., Dunkirk, N. Y.
Marshalltown Mfg. Co., 901 E. Nevada, Marshalltown, Ia.
Martin, J. O. & C. U., 637 Minna St., San Francisco, Cal.
Martin & Sons, H. P., 301 W. 12th St., Owensboro, Ky.
Martin-Parry Corp., W. Market St., York, Pa.
Martocello & Co., Jos. A., 229 N. 13th St., Philadelphia, Pa.
Masonite Corp., 111 W. Washington St., Chicago, Ill.
Mason-Neilan Regulator Co., 1190 Adams St., Boston, Mass.
Master Electric Co., 100 Davis Ave., Dayton, O.
Master Welders, 2524 Holmes St., Kansas City, Mo.
Matthiessen & Hegeler Zinc Co., 9th & Sterling Sts., La Salle, Ill.
Mauck Seamless Copper Tank Co., Victor, 309 E. Main, Norristown, Pa.
Maurath, Inc., 7309 Union Ave., Cleveland, O.
Maxim Silencer Co., 410 Asylum St., Hartford, Conn.
Maxweld Corp., 140 13th St., Brooklyn, N. Y.
Mayflower-Lewis Corp., E. 7th St. at Duluth, St. Paul, Minn.
Mayson Mfg. Co., Inc., 4332 Horatio St., Detroit, Mich.
Maysteel Products, Inc., Mayville, Wis.
McAlear Mfg. Co., 1901-1909 S. Western Ave., Chicago, Ill.
McAuley Automatic Trap Co., Imperial Power Bldg., Pittsburgh, Pa.
McClave-Brooks Co., Poplar & Park Sts., Scranton, Pa.
McCord Radiator & Mfg. Co., 2587 E. Grand Blvd., Detroit, Mich.
McCorkle Co., D. H., 6th & Bancroft Way, Berkeley, Cal.
McCormick & Co., J. H., Foot of Susquehanna St., Williamsport, Pa.
McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill.
McGowan Co., John H., 54-58 Central Ave., Cincinnati, O.
McKay Co., McKay Bldg., 1005 Liberty Ave., Pittsburgh, Pa.
●McQuay, Inc., 1600 Broadway, N. E., Minneapolis, Minn.
McWane Cast Iron Pipe Co., 1201 Vanderbilt Rd., Birmingham, Ala.
●Mears-Kane-Ofeldt, Inc., 1903-1915 E. Hagert St., Philadelphia, Pa.
Mechanical Air, 801 Thomas St., Little Rock, Ark.
Medart Co., 3500 DeKalb, St. Louis, Mo.
Meier Electric & Machine Co., 3525 E. Washington St., Indianapolis, Ind.
Mellish & Murray Co., 1715 Carroll Ave., Chicago, Ill.
Merchant & Evans Co., 2035 Washington Ave., Philadelphia, Pa.
Mercoid Corp., 4201 Belmont Ave., Chicago, Ill.
Merco-Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Meriam Co., The, 1955 W. 112th St., Cleveland, O.
Merrell Mfg. Co., 644 Curtis St., Toledo, O.
Metalace Corp., 60 K St., South Boston, Mass.
Metallo Gasket Co., 16 Bethany St., New Brunswick, N. J.
Metropolitan Refining Co., Inc., 23-28 50th Ave., Long Island City, N. Y.
Mettler Co., Lee B., 406 S. Main St., Los Angeles, Cal.
Meyer & Bro. Co., F., 1313 S. Adams St., Peoria, Ill.
Meyer Mfg. Co., 4823 Wabash Ave., Detroit, Mich.
Michigan Pipe Co., 503 Phoenix Bldg., Bay City, Mich.
Micro Switch Corp., 1 E. Spring St., Freeport, Ill.
Micro-Westco, Inc., Bettendorf Office Bldg., Bettendorf, Ia.
Mid-Continent Petroleum Corp., Tulsa, Okla.
●Midwest Piping & Supply Co., Inc., Second and Barry St., St. Louis, Mo.
Milburn Co., Alexander, 1420 W. Baltimore St., Baltimore, Md.
Milcor Steel Co., S. 41st & Burnham Sts., Milwaukee, Wis.
Miller & Connell Co., 1454-56 N. Claremont Ave., Chicago, Ill.
Miller Electric Mfg. Co., 905 N. Meade St., Appleton, Wis.
Miller Rubber Co., Inc., 1247 S. High St., Akron, O.
Millers Falls Co., 57 Wells St., Greenfield, Mass.
Mills Novelty Co., 4110 W. Fullerton Ave., Chicago, Ill.
Milwaukee Reliance Boiler Wks., 2784 N. 32nd St., Milwaukee, Wis.
Milwaukee Valve Co., Chase & Burrell Sts., Milwaukee, Wis.
Mineral Felt Co., 2288 Albion St., Toledo, O.
Mineral Insulation Co., 103rd & Southwest Highway, Chicago Ridge, Ill.
●Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, Minn.
Mitchell Moulding Co., 1501-15 Circle Ave., Forest Park, Ill.
Mitchell & Smith, Inc., 9469 Copeland Ave., Detroit, Mich.
Modern Engineering Co., 3411 Pine Blvd., St. Louis, Mo.
Modern Equipment Corp., Defiance, O.
Modine Mfg. Co., 17th St., Racine, Wis.
Moeller Instrument Co., 132nd St. & 89th Ave., Richmond Hill, N. Y.
Mojonnier Bros. Co., 4601 W. Ohio St., Chicago, Ill.
Molock Foundry & Machine Co., Kaukauna, Wis.
●Monarch Mfg. Works, Inc., Salmon & Westmoreland Sts., Philadelphia, Pa.
Monarch Metal Weatherstrip Co., 6333 Etzel Ave., St. Louis, Mo.
Monash-Younker Co., 1315 W. Congress St., Chicago, Ill.
Monat Valve & Forge Co., Inc., 900 Bessemer Bldg., Pittsburgh, Pa.
Moncrief Furnace Co., P. O. Box 1673, Atlanta, Ga.
Monitor Controller Co., 51 S. Gay St., Baltimore, Md.
Montag Stove & Furnace Wks., 2011 N. Columbia Blvd., Portland, Ore.
Montgomery Bros., 61 Fremont St., San Francisco, Cal.
Moore Steam Turbine Corp., Wellsville, N. Y.
Moran Flexible Steam Joint Co., 217 W. Main St., Louisville, Ky.
Morehead Mfg. Co., 4895 Grand River Ave., Detroit, Mich.
Morey & Jones, Ltd., 922 S. Hemlock St., Los Angeles, Cal.
Morris Machine Wks., 50 E. Genesee St., Baldwinsville, N. Y.
Morse Chain Co., Turner Pl., Ithaca, N. Y.
Mortell Co., J. W., 310 S. Michigan Ave., Chicago, Ill.
Motor Equipment Co., 214 W. Douglas, Wichita, Kans.
Mouat Vapor Heating Co., The, 1246-1254 W. 4th St., Cleveland, O.
Mountain States Equipment Co., 1238 Speer Blvd., Denver, Colo.
Mueller Brass Co., Lapeer Ave., Port Huron, Mich.
Mueller Co., Decatur, Ill.
Mueller Furnace Co., L. J., 2005 W. Oklahoma Ave., Milwaukee, Wis.
Mueller Steam Specialty Co., Inc., 351 W. 26th St., New York, N. Y.
Mullins Mfg. Corp., 1021 Mill St., Salem, O.
Multi-Seal Mfg. Co., 123 N. Jefferson St., Chicago, Ill.
Muncie Gear Wks., Inc., Muncie, Ind.
●Mundet Cork Corp., 65 S. 11th St., Brooklyn, N. Y.
Murdock Mfg. & Supply Co., 426-30 Plum St., Cincinnati, O.
Murray Iron Wks. Co., 1106 Washington St., Burlington, Ia.
Murray Mfg. Co., D. J., Wausau, Wis.
Mutual Chemical Co. of America, 270 Madison Ave., New York, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
Myers Electric Co., 410 Third Ave., Pittsburgh, Pa.

N

●Nash Engineering Co., South Norwalk, Conn.
Nash Refrigeration Co., Inc., 79 Poinier St., Newark, N. J.
Nason Co., 1050 Mt. Elliot Ave., Detroit, Mich.
National Air Conditioning & Engineering Corp., 2620 Charlotte Ave., Kansas City, Mo.
National Airoil Burner Co., Inc., 1327 Girard Ave., Philadelphia, Pa.
National Aluminate Corp., 6621 W. 66th Pl., Chicago, Ill.
National Boiler Improvement Co., 4100 Georgia Ave., Washington, D. C.
National Brass Co., 1603 Madison Ave., Grand Rapids, Mich.
National Brass & Copper Co., Inc., Lisbon, O.
National Gypsum Co., Delaware Ave., Buffalo, N. Y.
National Laboratories, Inc., 501 Statler Bldg., Boston, Mass.
National Lead Co., 111 Broadway, New York, N. Y.
National Machine Wks., Peoples Gas Bldg., Chicago, Ill.
National Metal Products Corp., 21 N. Loomis St., Chicago, Ill.
National Meter Co., 4221 First Ave., Brooklyn, N. Y.
National Pipe Bending Co., 122 River St., New Haven, Conn.
National Radiator Corp., 221 Central Ave., Johnstown, Pa.
National Regulator Div., Minneapolis-Honeywell Regulator Co., Mfg.: 2301 N. Knox Ave., Chicago, Ill. Sales: 2701 Fourth Ave., S., Minneapolis, Minn.
National Steam Pump Co., 701 W. Johnson St., Upper Sandusky, O.
National Steel Corp., Grant Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
National Valve & Mfg. Co., 3101 Liberty Ave., Pittsburgh, Pa.
Naugatuck Mfg. Co., Union City, Conn.
Naylor Pipe Co., 1251 E. 92nd St., Chicago, Ill.
Neemes Foundry, Inc., 216 First St., Troy, N. Y.
Nelson Co., 2604 Fourth Ave., Detroit, Mich.
Nelson Corp., Herman, 2nd St., Moline, Ill.
Nelson Mfg. Co., B. F., Corner Main & Marshall Sts., N. E., Minneapolis, Minn.
Neptune Meter Co., 50 W. 50th St., New York, N. Y.
●Nesbitt, Inc., John J., & Buckeye Blower Co., State Rd. & Rhawn St., Philadelphia, Pa.
New Albany Machine Mfg. Co., E. 10th & Water Sts., New Albany, Ind.
New Departure Div., General Motors Corp., Bristol, Conn.
New Haven Copper Co., Seymour, Conn.
New Jersey Zinc Sales Co., Front & Fletcher Sts., New York, N. Y.
Newark Wire Cloth Co., 351 Verona Ave., Newark, N. J.
New York Air Valve Corp., 611-621 Broadway, New York, N. Y.
New York Blower Co., 3155 Shields Ave., Chicago, Ill.
New York Brass Foundry, 405 Broome St., New York, N. Y.
Newman Brothers, Inc., 666 W. Fourth St., Cincinnati, O.
Newman Co., Inc., I. C., 6 E. 45th Str., New York, N. Y.
Newport Rolling Mill Co., Ninth & Lowell Sts., Newport, Ky.
Niagara Blower Co., 6 E. 45th St., New York, N. Y.
Niagara Machine & Tool Wks., 637-697 Northland Ave., Buffalo, N. Y.
Nicholson & Co., W. H., 12 Oregon St., Wilkes-Barre, Pa.
Niles Rolling Mill Co., Niles, O.
Norge Div., Borg-Warner Corp., 670 E. Woodbridge St., Detroit, Mich.
Norge Heating & Conditioning Div., Borg-Warner Corp., 670 E. Woodbridge St., Detroit, Mich.
Norgren Co., Inc., C. A., 222 Santa Fe Dr., Denver, Colo.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Norristown Magnesia & Asbestos Co., Washington St., Norristown, Pa.
North American Mfg. Co., 2910 E. 75th, Cleveland, O.
Northern Blower Co., 6409 Barberton Ave., Cleveland, O.
Northern Equipment Co., 1945 Grove Drive, Erie, Pa.
Northern Indiana Brass Co., 935 Plum St., Elkhart, Ind.
Northern Weatherstrip Co., 367 S. First Ave., E., Duluth, Minn.

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Norwin Co., E. Album St., Freeport, Ill.
Norwood Engineering Co., The, N. Maple St., Florence, Mass.
Nugent Sons, Inc., Thos., 223 E. 80th St., New York, N. Y.
Nu-Way Corp., 2416-4th Ave., Rock Island, Ill.
Nye Tool & Machine Wks., The, 4120-30 Fullerton Ave., Chicago, Ill.

O

Oakite Products, Inc., 22 Thames St., New York, N. Y.
Oberdorfer Brass Co., M. L., 2307 Thompson Rd., Syracuse, N. Y.
Ohio Brass Co., N. Main St., Mansfield, O.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Works & Foundry Co., Eureka Valve Div., 2735 Colerain Ave., Cincinnati, O.
Ohio Pipe Bending & Machine Co., 3900-3910 Trent Ave., Cleveland, O.
Ohio Products Co., 16507 Lucille Ave., Cleveland, O.
Ohio Welder Co., Middlefield, O.
Ohl & Son, George A., 159 Oraton St., Newark, N. J.
Oil Well Supply Co., Oil City, Pa.
Orr & Sembower, Inc., Box 817, Reading, Pa.
Oster Mfg. Co., 2057 E. 61st Pl., Cleveland, O.
Otis Steel Co., 3341 Jennings Rd., Cleveland, O.
Owen-Dyneto Corp., Syracuse, N. Y.
Owens-Corning Fiberglas Corp., Second National Bank Bldg., Toledo, O.
Ozo-Ray Process Corp., 400 N. Sangamon St., Chicago, Ill.

P

PS Inc., 1227-35 Wall St., Los Angeles, Cal.
●Pacific Lumber Co., The, 100 Bush St., San Francisco, Cal.
Pacific Steel Boiler Div., United States Radiator Corp., 1056 First National Bank Bldg., Detroit, Mich.
Page Steel & Wire, Div. of American Chain Co., Inc., Monessen, Pa.
Paine Co., 2951 W. Carroll Ave., Chicago, Ill.
●Pains Fireworks Display Co., 22 Park Pl., New York, N. Y.
Palmer Co., 2501 Norwood Ave., Cincinnati (Norwood), O.
Palmer Electric Co., 20 Sproat St., Detroit, Mich.
Pangborn Corp., Pangborn Blvd., Hagerstown, Md.
Paragon Electric Co., 37 W. Van Buren St., Chicago, Ill.
Parker Appliance Co., 17325 Euclid Ave., Cleveland, O.
Parker-Kalon Corp., 200 Varick St., New York, N. Y.
Parks-Cramer Co., 970 Main St., Fitchburg, Mass.
Parsons, John R., 151 E. 19th St., New York, N. Y.
Patterson Foundry & Machine Co., East Liverpool, O.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Patterson Shade Co., 1142 N. Meridian St., Indianapolis, Ind.
Paxtix, Inc., 308 W. Washington St., Chicago, Ill.
Payne Furnace & Supply Co., Inc., 336-338 N. Foothill Rd., Beverly Hills, Cal.
Peabody Engineering Corp., 580 Fifth Ave., New York, N. Y.
Peck, Stow & Wilcox Co., Center St., Southington, Conn.
Pecora Paint Co., 4th & Penna. R. R., Philadelphia, Pa.
Peerless of America, Inc., 515 W. 35th St., Chicago, Ill.
Peerless Electric Co., 3021 W. Market St., Warren, O.
Peerless Machine Co., 1615 Racine St., Racine, Wis.
Peerless Pump Div., Food Machinery Corp., 300 Walnut Rd., Massillon, O.
Peerless Unit Ventilation Co., Inc., 810 Union Ave., Bridgeport, Conn.
Pels & Co., Inc., Henry, 90 West St., New York, N. Y.
Penberthy Injector Co., 1242 Holden Ave., Detroit, Mich.
Penn Cooling Tower Wks., 1337 Nixon St., Pittsburgh, Pa.
Penn Electric Switch Co., Box 556, Goshen, Ind.
Penn Mfg. Corp., of Washington, Pa., 380 W. Chestnut St., P. O. Box 484, Washington, Pa.
Pennsylvania Engineering Wks., 526 S. Jefferson St., New Castle, Pa.
Pennsylvania Forge Co., Milnor & Bleigh Sts., Philadelphia, Pa.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Pennsylvania Salt Mfg. Co., 1335 Chestnut St., Philadelphia, Pa.
Perfection Grate & Stoker Co., 4 Fisk Ave., Springfield, Mass.
Perfection Refrigeration Parts Co., Harvey, Ill.
Perfex Corp. (Controls Div.), 415 W. Oklahoma Pl., Milwaukee, Wis.
Perfex Corp. (Unit Heater Div.), 415 W. Oklahoma Pl., Milwaukee, Wis.
Perkins & Son, Inc., B. F., Chicopee St., Holyoke, Mass.
Permutit Co., 330 W. 42nd St., New York, N. Y.
Petroleum Heat & Power Co., 110 Davenport St., Stamford, Conn.
Petrometer Corp., 1 Star Sq., Long Island City, N. Y.
Pfening Co., Fred D., 1075 W. 5th Ave., Columbus, O.
Phelps Dodge Copper Products Corp., British American Tube Div., 40 Wall St., New York, N. Y.
Philadelphia Gear Co., Erie Ave. & G St., Philadelphia, Pa.
Philadelphia Pipe Bending Co., 4135-65 N. Fifth St., Philadelphia, Pa.
Philadelphia & Reading Coal & Iron Co., N. E. Cor. 12th & Market Sts., Philadelphia, Pa.
Philadelphia Thermometer Co., 915 Filbert St., Philadelphia, Pa.
Philco Radio & Television Corp., 3710 N. Broad St., Philadelphia, Pa.
Phoenix Brass Fittings Corp., Coit St. & Chancellor Ave., Irvington, N. J.
Phoenix Ice Machine Co., 2711 Church St., Cleveland, O.
Pierce Butler Radiator Corp., 701 Nichols Ave., Syracuse, N. Y.
Pierce Co., Wm. B., 41 N. Division St., Buffalo, N. Y.
Pilley Packing & Flue Brush Co., 606 S. Third St., St. Louis, Mo.
Pioneer Air Conditioning Corp., 1300 Stevens Ave., Minneapolis, Minn.
Pioneer Heat Regulator Div., Master Electric Co., The, 100 Davis Ave., Dayton, O.
Pioneer Roofing & Sheet Metal Co., 226 N. Main St., Muskogee, Okla.
Pipe Fabrication Institute, 1108 Clark Bldg., Pittsburgh, Pa.
Pittsburgh Brass Mfg. Co., 3155 Penn Ave., Pittsburgh, Pa.
Pittsburgh Equitable Meter Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Pittsburgh Lectrodryer Corp., P. O. Box 1766, Pittsburgh, Pa.
Pittsburgh Pipe Coil & Bending Co., 61 Bridge St., Etna, Pa.
Pittsburgh Piping & Equipment Co., 43rd St. & A. V. R. R., Pittsburgh, Pa.
Pittsburgh Steel Co., Union Trust Bldg., Pittsburgh, Pa.
Pittsburgh Tube Co., Vandergrift Bldg., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Pittsburgh Valve Foundry & Construction Co., 26th St. & Allegheny Valley R. R., Pittsburgh, Pa.
Pittsburgh Water Heater Co., Box 1109, Pittsburgh, Pa.
Plastergon Wall Board Co., Philadelphia Ave., Buffalo, N. Y.
Pleasantaire Corp., 1623 Connecticut Ave., Washington, D. C.
Plummer Spray Equipment Co., 700 Filmore St., Napoleon, O.
Plymouth Cordage Co., Court St., N. Plymouth, Mass.; Anderson Products, Inc., Cambridge, Mass., National Sales Agents.
Pomona Pump Co., 206 E. Commercial St., Pomona, Cal.; 53 W. Jackson Blvd., Chicago, Ill.
Poole Foundry & Machine Co., 1700 Union Ave., Woodberry, Baltimore, Md.
●Porter & Co., Inc., H. W., 825 Frelinghuysen Ave., Newark, N. J.
Powell Co., Wm., 2525 Spring Grove Ave., Cincinnati, O.
Power Piping Div., Blaw Knox Co., 829 Beaver Ave., Pittsburgh, Pa.
●Powers Regulator Co., 2720 Greenview Ave., Chicago, Ill.
●Practical Instrument Co., 2717 N. Ashland Ave., Chicago, Ill.
Presstite Engineering Co., 3900 Chauteau St., St. Louis, Mo.
Propellair, Inc., 1345 Lagonda Ave., Springfield, O.
Prox Co., Inc., Frank, 1201 S. First St., Terre Haute, Ind.
Public Works Supply Co., 93 Brookline St., Lynn, Mass.
Pure Carbonic, Inc., Lincoln Bldg., New York, N. Y.
Pyott Foundry & Machine Co., 328 N. Sangamon St., Chicago, Ill.
Pyrometer Instrument Co., 103 Lafayette St., New York, N. Y.

Q

Quaker City Iron Wks., Allegheny & Tulip Sts., Philadelphia, Pa.
Quickwork Co., 400 W. Madison St., Chicago, Ill.
Quimby Pump Co., Inc., 340 Thomas St., Newark, N. J.

R

R-S Products Corp., Germantown Ave., at Wayne Junction, Philadelphia, Pa.
R. U. V. Engineering Corp., 110 E. 42nd St., New York, N. Y.
Radiator Specialty Co., Charlotte, N. C.
Rafter Machine Co., 259 Stephens St., Belleville, N. J.
Raisler Sprinkler Co., 129 Amsterdam Ave., New York, N. Y.
Ramsay Chain Co., Inc., 1029 Broadway, Albany, N. Y.
Ranco, Inc., 601 W. 5th Ave., Columbus, O.
●Randall Graphite Products Corp., 609 W. Lake St., Chicago, Ill.
Ravena Iron Co., Ravena, N. Y.
Rawlplug Co., Inc., 98 Lafayette St., New York, N. Y.
Ray Oil Burner Co., 401-499 Bernal Ave., San Francisco, Cal.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.
Red Jacket Pump Co., Davenport, Ia.
Redi Automatic Coal Burners, Inc., N. 107 Freyar St., Spokane, Wash.
Reed Unit-Fans, Inc., 811 St. Charles St., New Orleans, La.
Reeves Steel & Mfg. Co., Dover, O.
Refinite Corp., Refinite Bldg., Omaha, Neb.
Refractory & Insulation Corp., 381 Fourth Ave., New York, N. Y.
Refrigeration Appliances, Inc., 917-923 W. Lake St., Chicago, Ill.
●Refrigeration Economics Co., Inc., 1232 Second St., N. E., Canton, O.
Rega Mfg. Co., 79 Mt. Hope Ave., Rochester, N. Y.
Register & Grille Mfg. Co., Inc., 70 Berry St., Brooklyn, N. Y.
Reichert Float & Mfg. Co., 2238 Smead Ave., Toledo, O.
Reif-Rexoil, Inc., 37-43 Carroll St., Buffalo, N. Y.
Reliance Electric & Engineering Co., Ivanhoe Rd., Cleveland, O.
Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland, O.
Reliance Refrigerating Machine Co., 3401 N. Kedzie Ave., Chicago, Ill.
●Rempe Co., 340 N. Sacramento Blvd., Chicago, Ill.

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Rensaeller Valve Co., Ontario St., Cohoes, N. Y.
Reps Tool, Inc., 220 Delaware Ave., Buffalo, N. Y.
Republic Flow Meters Co., 2240 Diversey Pkwy., Chicago, Ill.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
●Republic Steel Corp., Republic Bldg., Cleveland, O.
Research Corp., Chrysler Bldg., New York, N. Y.
Research Products Corp., 1011-1015 E. Washington Ave., Madison, Wis.
Resisto Pipe & Valve Co., 262 Bridge St., East Cambridge, Mass.
●Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Revolving Doors, Inc., 542 W. 27th, New York, N. Y.
Rex Clay Products Co., 14414 Dexter Blvd., Detroit, Mich.
Reznor Mfg. Co., Mercer, Pa.
Rhoads & Sons, J. E., 11th & B. & O. R. R., Wilmington, Del.
Rhode Island Fittings Co., Hillsgrove, R. I.
Rhode Island Humidifier & Ventilating Co., 99 Chauncey St., Boston, Mass.
Rhodes, Inc., M. H., 30 Bartholomew St., Hartford, Conn.
Richardson & Boynton Co., 244 Madison Ave., New York, N. Y.
Richmond Engineering Co., 1305 Brook Ave., Richmond, Va.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
●Ric-wiL Co., 1562 Union Trust Bldg., Cleveland, O.
Ridge Tool Co., Box 670, Elyria, O.
Riley Stoker Corp., 9 Neponset St., Worcester, Mass.
Riverside Boiler Wks., Inc., 50 Harvard St., Cambridge, Mass.
Robbins & Myers, Inc., Lagonda Ave., Springfield, O.
Roberts-Gordon Appliance Corp., 137 Arthur St., Buffalo, N. Y.
Robertson Co., H. H., 2000 Grant Bldg., Pittsburgh, Pa.
Rock Island Register Co., 2435 Fifth Ave., Rock Island, Ill.
Rock Products Co., 150 Fourth Ave., N., Nashville, Tenn.
Rock River Machine Co., Inc., N. Main St., Janesville, Wis.
Rockwood Mfg. Co., 1801-2001 English Ave., Indianapolis, Ind.
Rockwood Sprinkler Co., 38 Harlow St., Worcester, Mass.
Rock Wool Products Co., P. O. Box 276, Wabash, Ind.
Roebling's Sons, John A., South Broad St., Trenton, N. J.
Roessing Mfg. Co., 1616 Noble St., Sharpsburg Sta., Pittsburgh, Pa.
Roller Bearing Co. of America, Whitehead Rd., Trenton, N. J.
Rome-Turney Radiator Co., Canal St., Rome, N. Y.
Roots-Connersville Blower Corp., 16th St. & Columbia Ave., Connersville, Ind.
Roper Corp., Geo. D., Blackhawk Ave., Rockford, Ill.
Rosedale Foundry & Machine Co., Columbus & Preble Aves., N. S., Pittsburgh, Pa.
Ross Engineering Corp., J. O., 350 Madison Ave., New York, N. Y.
Ross Heater & Mfg. Co., Inc., 1407 West Ave., Buffalo, N. Y.
Ross Sprinkler Co., 34 Roberts St., Pasadena, Cal.
Ross Valve Mfg. Co., Inc., 6 Oakwood Ave., Troy, N. Y.
Rotary Mfg. Co., 5718 Long Beach Ave., Los Angeles, Cal.
Rotary Seal Co., 809 W. Madison St., Chicago, Ill.
Royal Ventilator Co., 415 Locust St., Philadelphia, Pa.
Ruberoid Co., 500 Fifth Ave., New York, N. Y.
Ruby Chemical Co., 74 McDowell St., Columbus, O.
Ruggles-Klingemann Mfg. Co., 4 Foster Ct., Salem, Mass.
Rumsey Pump Corp., Seneca Falls, N. Y.
Russell & Co., W. A., 420 Lexington Ave., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Russell Electric Co., 348 W. Huron St., Chicago, Ill.
Russell Insulation Co., F. C., 235 E. 131st St., Cleveland, O.
Russell Mfg. Co., John M., Naugatuck, Conn.
Ruud Mfg. Co., 2934 Smallman St., Pittsburgh, Pa.

S

SKF Industries, Inc., Front St. & Erie Ave., Philadelphia, Pa.
●St. Louis Blow Pipe & Heater Co., 1954 N. 9th St., St. Louis, Mo.
Sac Tool Mfg., 1907 Washington Ave., St. Louis, Mo.
Sales & Co., Murray W., 801 W. Baltimore Ave., Detroit, Mich.
Sall Mountain Co., 176 W. Adams St., Chicago, Ill.
Sangamo Electric Co., 1301 N. 11th St., Springfield, Ill.
●Sarco Co., Inc., 183 Madison Ave., New York, N. Y.
Sauereisen Cements Co., 2308 Main St., Sharpsburg, Pa.
Saunders Sons, Inc., D., 25 Atherton St., Yonkers, N. Y.
Scaife & Sons Co., Wm. B., 26 Ann St., Oakmont, Pa.
Schade Valve Mfg. Co., 2527 N. Bodine St., Philadelphia, Pa.
Schatz Mfg. Co., Fairview, Poughkeepsie, N. Y.
Schatz Venetian Blinds, Los Angeles, Cal.
Schaub Engineering Co., Fred H., 325 W. Huron St., Chicago, Ill.
Schneible Co., Claude B., 3951 Lawrence Ave., Chicago, Ill.
Schoedinger, F. O., 322-358 Mt. Vernon Ave., Columbus, O.
Schramm, Inc., West Chester, Pa.
Schubert-Christy Corp., Box 166, Affton Station, St. Louis, Mo.
Schundler & Co., Inc., F. E., 45-15 Vernon Blvd., Long Island City, N. Y.
Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa.
Schwitzer-Cummins Co., Fan St., Indianapolis, Ind.
Scientific Instrument Co., 531-35 W. Larned, Detroit, Mich.
Scott-Newcomb, Inc., 1922 Pine St., St. Louis, Mo.
Scott Valve Mfg. Co., 3963 McKinley Ave., Detroit, Mich.
●Scovill Mfg. Co., 99 Mill Street, Waterbury, Conn.
Sealkote Corp., 40 S. Clinton St., Chicago, Ill.
Seamlex Co., 5-18 48th Ave., Long Island City, N. Y.
Self-Vulcanizing Rubber Co., Inc., 605 W. Washington Blvd., Chicago, Ill.
Semet-Solvay Engineering Corp., 40 Rector St., New York, N. Y.
Semler Co., Jannette, Pa.
Seneca Wire & Mfg. Co., Fostoria, O.
Servel, Inc., Electric Refrigeration & Air Conditioning Div., 119 Morton Ave., Evansville, Ind.
Service To Industry, Box 133, West Hartford, Conn.
Shafer Bearing Corp., 35 E. Wacker Dr., Chicago, Ill.
Shallcross Co., 4846 and Grays Ferry Rd., Philadelphia, Pa.
Shallcross Controls, Inc., 121 N. Broadway, Milwaukee, Wis.
Shank, Cyrus, 625 W. Jackson Blvd., Chicago, Ill.
Sharon Steel Corp., Sharon, Pa.
Shaw Co., Benjamin F., Second & Lombard Sts., Wilmington, Del.
Shaw-Kendall Engineering Co., 120-130 S. Superior St., Toledo, O.
●Shaw-Perkins Mfg. Co., Oliver Bldg., Pittsburgh, Pa.
Sheer Co., H. M., Second & Hampshire Sts., Quincy, Ill.
Sheffler-Gross Co., Drexel Bldg., Philadelphia, Pa.
Sight Feed Generator Co., 14-18 N. 10th St., Richmond, Ind.
Silent Glow Oil Burner Corp., 1477 Park St., Hartford, Conn.
Simmons Co., Gordon H., 926 N. Cass St., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., Pettyjohn Bldg., Lynchburg, Va.
Simplex Oil Heating Corp., 21 West St., New York, N. Y.
Sims Co., 18th & Whitley Sts., Erie, Pa.
Sinclair Refining Co., 45 Nassau, New York, N. Y.
Sinker-Davis Co., 230 S. Missouri St., Indianapolis, Ind.
Skidmore Corp., St. Joseph, Mich.
Skilsaw, Inc., 3310 N. Elston Ave., Chicago, Ill.
Skinner Co., M. B., South Bend, Ind.
Skinner Engine Co., 337 W. 12th St., Erie, Pa.
Skinner Irrigation Co., 1212 E. Canal St., Troy, O.
Slater Mfg. Co., 24 Water St., Wakefield, Mass.
Sly Mfg. Co., W. W., 4700 Train Ave., Cleveland, O.
Smith Co., H. B., 57 Main, Westfield, Mass.
Smith Heater Co., Peter, 6209 Hamilton St., Detroit, Mich.
Smith, Inc., James Campbell, 1679 Collamer Rd., Cleveland, O.
Smith, Inc., Winfield H., Eaton St., Springville, N. Y.
Smith & Kanzler, Inc., 516-534 Lidgerwood Ave., Elizabeth, N. J.
Smith Twin Tubular Boiler Co., Inc., Cottman St., at State Rd., Philadelphia, Pa.
Smith Welding Equipment Co., 2633 S. E. Fourth St., Minneapolis, Minn.
Smolensky Valve Co., Inc., 1931 W. 47th St., Cleveland, O.
Smooth-On Mfg. Co., 568-574 Communipaw Ave., Jersey City, N. J.
Snap-On Tools Corp., Kenosha, Wis.
Snead, Herbert S., 205 E. 42nd St., New York, N. Y.
●Somers, Inc., H. J., 6063 Wabash Ave., Detroit, Mich.
Somerville Iron Wks., Somerville, N. J.
South Bend Air Products Corp., 304 E. Colfax Ave., South Bend, Ind.
South Chester Tube Co., Front & Thurlow Sts., Chester, Pa.
Southworth Machine Co., 30 Warren Ave., Portland, Me.
Spang Chalfant, Inc., Grant Bldg., Pittsburgh, Pa.
Specialty Converters, Inc., 161 E. Erie St., Chicago, Ill.
Speedway Mfg. Co., 1834 S. 52nd Ave., Chicago (Cicero), Ill.
Spence Engineering Co., Inc., 32 Grant St., Walden, N. Y.
Spencer Heater Div., Lycoming Mfg. Co., 652 Oliver St., Williamsport, Pa.
Spencer Thermostat Co., 43 Forest St., Attleboro, Mass.
Spencer Turbine Co., 486 New Park Ave., Hartford, Conn.
●Spoehrer-Lange Co., 3723 Commonwealth St., St. Louis, Mo.
Spray Engineering Co., 114 Central St., Somerville, Mass.
●Spraying Systems Co., 4922 W. Grand Ave., Chicago, Ill.
Sprayo-Flake Co., 2715 Irving Park Blvd., Chicago, Ill.
Sprout-Waldron & Co., Muncy, Pa.
Square D Co., 6060 Rivard St., Detroit, Mich.
Square D Co., 710 S. 3rd St., Milwaukee, Wis.
Squires Co., C. E., E. 4th St. & Keeley Ave., Cleveland, O.
Standard Air Conditioning, Inc., 40 W. 40th St., New York, N. Y.
Standard Asbestos Mfg. Co., 820-822 W. Lake St., Chicago, Ill.
Standard Auto-Tite Joint Co., 7501 Thomas Blvd., Pittsburgh, Pa.
Standard Engineering Wks., 289 Roosevelt Ave., Pawtucket, R. I.
Standard Lime and Stone Co., 2004 First National Bank Bldg., Baltimore, Md.
Standard Oil Co., of California, 225 Bush, San Francisco, Cal.
Standard Oil Co. of Indiana, 910 S. Michigan Ave., Chicago, Ill.
Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y.
Standard Products Co., Fisher Bldg., Detroit, Mich.
Standard Thermometer, Inc., 65 Shirley St., Boston, Mass.
Standard Union Co., 71 Gooding St., Lockport, N. Y.
Stanley Wks., 195 Lake St., New Britain, Conn.
Staples & Pfeiffer, Ltd., 528 Bryant St., San Francisco, Cal.
Star Electric Motor Co., 197 Grove St., Bloomfield, N. J.
Star Expansion Bolt Co., 147 Cedar St., New York, N. Y.
Star Mfg. Co., Inc., 530 Kinsley Ave., Providence, R. I.
Star Products Co., 130 Walnut Ave., New York, N. Y.
Star Radiator Co., 649 Ceres Ave., Los Angeles, Cal.
Starr Piano Co., Richmond, Ind.
Staynew Filter Corp., 25 Leighton Ave., Rochester, N. Y.
Steamaire Co., Cincinnati, O.
Steel Improvement & Forge Co., 960 Addison Rd., Cleveland, O.

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Steel Products Engineering Co., Columbia St. & Dakota Ave., Springfield, O.
Steel and Tubes, Inc., 224 E. 131st St., Cleveland, O.
Steelweld Machinery Co., E. 70th & Machinery Ave., Cleveland, O.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Cal.
Sterling Engineering Co., 3738 N. Holton St., Milwaukee, Wis.
Sterling Engineering & Mfg. Corp., 117 Business St., Hyde Park, Mass.
Stevens-Root Co., 51 E. Grand Ave., Chicago, Ill.
Stewart Ice Machine Co., 1046 E. 22nd St., Los Angeles, Cal.
Stickle Steam Specialties Co., 2215 Valley Ave., Indianapolis, Ind.
Stilphen Engineering & Mfg. Co., C. A., 1129 18th St., Denver, Col.
Stockham Pipe Fittings Co., 4100 Tenth Ave., N., Birmingham, Ala.
Stok-A-Fire Co., 900 S. 23rd St., St. Louis, Mo.
Stokermatic Co., 1415 S. State St., Salt Lake City, Utah.
Stokes Rubber Co., Jos., Taylor & Webster, Trenton, N. J.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, 218 S. Geddes St., Syracuse, N. Y.
Strandwitz & Co., Inc., W. J., Jefferson and Master Sts., Camden, N. J.
Streamline Pipe & Fittings Div., Mueller Brass Co., Lapeer Ave., Port Huron, Mich.
Strong, Carlisle & Hammond Co., The., 1394 W. Third St., Cleveland, O.
Strong-Scott Mfg. Co., Taft & Kennedy Sts., N. E., Minneapolis, Minn.
Struthers-Wells-Titusville Co., Warren, Pa.
Sturtevant Co., B. F., Damon St., Hyde Park, Boston, Mass.
Sturtevant Mill Co., Park and Clayton Sts., Dorchester, Boston, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Super Radiator Corp., 320 Plymouth Bldg., Minneapolis, Minn.
Superior Sheet Steel Co., The, Division of Continental Steel Corp., Canton-Louisville Rd., Canton, O.
Superior Valve and Fittings Co., 500 37th St., Pittsburgh, Pa.
Superstat Co., 38 Walter St., Springfield, Mass.
Supreme Air Filter Co., 126 W. 21st St., New York, N. Y.
Supreme Electric Products Corp., 99 Mt. Hope Ave., Rochester, N. Y.
Supreme Heater & Ventilating Corp., 1911 N. Market St., St. Louis, Mo.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Swaby Mfg. Co., 2330 W. Cermak Rd., Chicago, Ill.
Swartwout Co., 18511 Euclid Ave., Cleveland, O.
Swedish Venetian Blind Co., 601 W. 26th St., New York, N. Y.
Swoboda, Inc., H. O., 13th St., New Brighton, Pa.

T

Taber Pump Co., 272 Elm St., Buffalo, N. Y.
Taco Heaters, Inc., 342 Madison Ave., New York, N. Y.
Tagliabue Mfg. Co., C. J., 540 Park Ave., Brooklyn, N. Y.
●Tallmadge & Co., Webster, 225-255 N. 18th St., East Orange, N. J.
Taylor Engineering Co., Metropole Hotel, Cincinnati, O.
Taylor Forge & Pipe Wks., P. O. Box 485, Chicago, Ill.
●Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.
Tecumseh Products Co., Tecumseh, Mich.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Terry Steam Turbine Co., 874 Windsor Ave., Hartford, Conn.
Texas Co., 135 E. 42nd St., New York, N. Y.
Textite Corp., 2110 Roscoe St., Chicago, Ill.
Thatcher Furnace Co., 39 St. Francis St., Newark, N. J.
Thermal Units Mfg. Co., Div. of Air Devices Corp., 70 Britannia St., Meriden, Conn.
Therminsul Corp., 1603 Fulford St., Kalamazoo, Mich.
Thermoid Rubber Co., Whitehead Rd., Trenton, N. J.
Thermo-Mix, Inc., 129 Grand Ave., Brooklyn, N. Y.
Thrush & Co., H. A., Peru, Ind.
Thwing-Albert Instrument Co., 3339 Lancaster Ave., Philadelphia, Pa.
Tierney Rotor Ventilator Co., 239 Fourth Ave., S., Minneapolis, Minn.
Timken Roller Bearing Co., 1835 Dueber Ave., S. W., Canton, O.
Timken Steel & Tube Co., Canton, O.
Tippett & Wood, Taylor & Wilson Sts., Phillipsburg, N. J.
Titeflex Metal Hose Co., 500 Frelinghuysen Ave., Newark, N. J.
Titusville Iron Wks. Co., S. Franklin St., Titusville, Pa.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
Todd Combustion Equipment, Inc., Foot 23rd St., Brooklyn, N. Y.
Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo, O.
Torchweld Equipment Co., 1035 W. Lake St., Chicago, Ill.
Tork Clock Co. Inc., 33 South St., Mt. Vernon, N. Y.
Torrey Refrigeration Products, 1000 N. Orange Dr., Los Angeles, Cal.
Torrington Mfg. Co., 70 Franklin St., Torrington, Conn.
Trageser Steam Copper Wks., John, 5000 Grand St., Maspeth, Long Island, N. Y.
●Trane Co., La Crosse, Wis.
Trent Co., Harold E., 618-640 N. 54th St., Philadelphia, Pa.
●Trenton Auto Radiator Wks., 626 Brunswick Ave., Trenton, N. J.
Trerice Co., H. O., 1420 W. Lafayette Blvd., Detroit, Mich.
Trimont Mfg. Co., 55-71 Amory St., Roxbury, Boston, Mass.
Trimount Rotary Power Co., 398 Whiting Ave., East Dedham, Mass.
Triox Engineering Co., 207 Board of Education Bldg., St. Louis, Mo.
Triplex Mfg. Co., Peru, Ind.
Triumph Ice Machine Co., 107-109 E. Front St., Cincinnati, O.
Troy Engine & Machine Co., Troy, Pa.
Trumbull Electric Mfg. Co., Woodford Ave., Plainville, Conn.
Truscon Steel Co., 1315 Albert St., Youngstown, O.
Tryco Products, Inc., Railroad Sq., Westfield, Mass.
●Tube-Turns, Inc., 224 E. Broadway, Louisville, Ky.
Turner Brass Wks., 823-47 Park Ave., Sycamore, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago, Ill.
●Tuttle & Bailey, Inc., Corbin Ave., New Britain, Conn.
XXth Century Heating and Ventilating Co., Cor. Ira & Edison Aves., Akron, O.

U

●U. S. Air Conditioning Corp., 2101 Kennedy St., N. E., Minneapolis, Minn.
U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles, Cal.
U. S. Electrical Tool Co., 2488-2496 W. 6th St., Cincinnati, O.
U. S. Expansion Bolt Co., P. O. Box 357, State St. & P. R. R., York, Pa.
U. S. Hame Co., 135 Tonawanda St., Buffalo, N. Y.
U. S. Motors Corp., Oshkosh, Wis.
U. S. Pipe Bending Co., 840 Harrison St., San Francisco, Cal.
U. S. Stoneware Co., 60 E. 42nd St., New York, N. Y.
Uehling Instrument Co., 473 Getty Ave., Paterson, N. J.
Una Welding, Inc., 1615 Collamer Ave., E., Cleveland, O.
Underground Steam Construction Co., 73 Pitts St., Boston, Mass.
Unified Air Conditioner Co., Torry Bldg., Duluth, Minn.
Uniflow Mfg. Co., E. Lake Rd., Erie, Pa.
●Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Union Iron Wks., 1500 Cascade St., Erie, Pa.
Union Metal Wks., Inc., 80 Carter St., Chelsea, Mass.
Union Steam Pump Co., Jefferson Ave., Battle Creek, Mich.
Union Water Meter Co., 333 Hermon St., Worcester, Mass.
●Unit Heater & Cooler Co., 1002-1024 Third St., Wausau, Wis.
United Cork Companies, Central Ave., Kearney, N. J.
United Electric Controls Co., 69 A St., Boston, Mass.
United Metal Hose Co., Inc., 36-01 43rd Ave., Long Island City, N. Y.
United Motors Service Co., General Motors Bldg., Detroit, Mich.
United States Brass & Copper Co., Hyde Park, Boston, Mass.
United States Gauge Co., 44 Beaver St., New York, N. Y.
United States Gypsum Co., 300 W. Adams St., Chicago, Ill.
United States Mineral Wool Co., 9 S. Clinton St., Chicago, Ill.
United States Ozone Co. of America, Crescent St., Scottdale, Pa.
United States Pipe & Foundry Co., Burlington, N. J.
United States Radiator Corp., 1056 National Bank Bldg., Detroit, Mich.
United States Register Co., Burnham St., Battle Creek, Mich.
United States Rubber Co., 1790 Broadway, New York, N. Y.
United States Steel Corp., Pittsburgh, Pa.
United Superior Union Co., Inc., 29 Ryerson St., Brooklyn, N. Y.
Universal Air Filter Corp., Duluth, Minn.
●Universal Cooler Corp., Green & Melville Aves., Detroit, Mich.
Universal Gypsum & Lime Co., 105 W. Madison St., Chicago, Ill.
Universal Motor Co., 323 Universal Ave., Oshkosh, Wis.
Universal Power Corp., 4300 Euclid Ave., Cleveland, O.
Uno Ventilator Co., 565 Lincoln Ave., Cliftondale, Mass.
Upson Co., Upson Point, Lockport, N. Y.
Utica Products, Inc., 1101 Burrstone Rd., Utica, N. Y.
Utica Radiator Corp., 2201 Dwyer Ave., Utica, N. Y.
Utility Fan Corp., 2528 Santa Fe Ave., Los Angeles, Cal.

V

Vallen, Inc., 225 Bluff, Akron, O.
Vanderman Mfg. Co., Mansfield Ave., Willimantic, Conn.
Van Kannel Revolving Door Co., 101 Park Ave., New York, N. Y.
Ventilating Products Co., 2800 Cottage Grove Ave., Chicago Ill.
Vento Steel Sash Co., Muskegon, Mich.
Verson Allsteel Press Co., 93rd & Kenwood Ave., Chicago, Ill.
Vibration Eliminator Co., 25-08 37th Ave., Long Island City, N. Y.
Victaulic Co. of America, 26 Broadway, New York, N. Y.
Victor Equipment Co., Kimball-Krogh Pump Div., 1010 E. 62nd St., Los Angeles, Cal.
Vigor-Aire Corp., 127 S. 5th St., Philadelphia, Pa.
Viking Air Conditioning Corp., Main & Center Sts., N. W., Cleveland, O.
Viking Pump Co., Fourth and State Sts., Cedar Falls, Ia.
Viking Shear Co., 1063 W. 19th St., Erie, Pa.
●Vilter Mfg. Co., 2148 S. First St., Milwaukee, Wis.
Vinco Co., Inc., 305 E. 45th St., New York, N. Y.
Virginia Smelting Co., West Norfolk, Va.
Vitreous Enameling & Stamping Co., 1381 Sedgwick Ave., New York, N. Y.
Vogt Machine Co., Henry, 10th & Ormsby Sts., Louisville, Ky.
Vortex Mfg. Co., 687 N. Tillamook St., Portland, Ore.

● Advertisement in this issue. See Index to Advertisers, page 168.

Voss Co., J. H. H., 408 Concord Ave., New York, N. Y.
Vulcan Electric Co., Lynn, Mass.
Vulcan Radiator Co., 26 Francis Ave., Hartford, Conn.

W

●Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo.
Wailes Dove-Hermiston Corp., 17 Battery Pl., New York, N. Y.
Waldron Corp., John, New Brunswick, N. J.
Wallace Supplies Mfg. Co., 1310 Diversey Pkwy., Chicago, Ill.
Walsh-Holyoke Steam Boiler Co., Holyoke, Mass.
Walsh-Spencer Co., 420 Boylston St., Boston, Mass.
Walworth Co., 60 E. 42nd St., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
Ward Leonard Electric Co., 37 South St., Mt. Vernon, N. Y.
Ward Machinery Co., 564 W. Washington Blvd., Chicago, Ill.
Warren Electric Appliance Company, Warren Bank & Trust Co. Bldg., Warren, Pa.
Warren Foundry & Pipe Corp., 11 Broadway, New York, N. Y.
Warren Shade Co., Inc., 2905 E. Hennepin Ave., Minneapolis, Minn.
Warren Steam Pump Co., Inc., Warren, Mass.
Washburne & Co., E. G., 207 Fulton St., New York, N. Y.
Water Cooling Tower Co., 605 W. Washington Blvd., Chicago, Ill.
Water Refining Co., 1123 Barthold, Ft. Wayne, Ind.
Waterfilm Boilers, Inc., 154 Ogden Ave., Jersey City, N. J.
●Waterloo Register Co., 2520 E. 4th St., Waterloo, Ia.
Watson & McDaniel Co., 440 N. Marshall, Philadelphia, Pa.
●Watson-Stillman Co., 140 Aldene Rd., Roselle, N. J.
Watts Regulator Co., 10 Embankment St., Lawrence, Mass.
Waukesha Motor Co., Waukesha, Wis.
Way Panel Loctor Co., Wollaston, Mass.
Wayne Oil Burner Corp., 800 Glasgow Ave., Fort Wayne, Ind.
Weatherhead Co., 620 Frankfort St., Cleveland, O.
●Webster & Co., Warren, 17th & Federal Sts., Camden, N. J.
Webster Electric Co., Clark & DeKoven Aves., Racine, Wis.
Wedge Protectors, Inc., 9522 Richmond Ave., Cleveland, O.
Weil-McLain Co., 641 W. Lake St., Chicago, Ill.
Weil Pump Co., 215-17 W. Superior St., Chicago, Ill.
Weinman Pump Co., 290 Spruce St., Columbus, O.
Weirton Steel Co., Weirton, W. Va.
Western Blower Co., 1800 Airport Way, Seattle, Wash.
Western Engineering & Mfg. Co., 1726 E. Washington Blvd., Los Angeles, Cal.
Western Felt Wks., 4029-4117 Ogden Ave., Chicago, Ill.
Western Furnaces, Inc., 3002 S. Chandler, Tacoma, Wash.
Western Hanger Co., 55 New Montgomery St., San Francisco, Cal.
Western Precipitation Corp., 1016 W. 9th St., Los Angeles, Cal.
Western Venetian Blind Co., 601 W. 26th St., New York, N. Y.
Western Wire Products Co., 1415-35 S. 18th St., St. Louis, Mo.
Westfalia Separator Co., 30 Orange St., Bloomfield, N. J.
Westinghouse Electric & Mfg. Co., Bloomfield, N. J.
Westinghouse Electric & Mfg. Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
Westinghouse Electric & Mfg. Co., Mansfield, O.
Westinghouse X-Ray Div., Long Island City, N. Y.
Weston Electrical Instrument Corp., 619 Frelinghuysen Ave., Newark, N. J.
Wheatland Tube Co., 606-608 Real Estate Trust Bldg., Philadelphia, Pa.
Wheelco Instruments Co., 1933 S. Halsted St., Chicago, Ill.
Wheeler Mfg. Co., C. H., 19th, Lehigh & Sedgley Aves., Philadelphia, Pa.
Wheeling Steel Corp., Wheeling Steel Corp. Bldg., Wheeling, W. Va.
White Mfg. Co., 2362 University Ave., St. Paul, Minn.
Whitehead Metal Products Co. of New York, Inc., 303 W. 10th St., New York, N. Y.
●White-Rodgers Electric Co., 1209 Cass Ave., St. Louis, Mo.
Whiting Corp., Harvey, Ill.
Whitlock Coil Pipe Co., 100 South St., Hartford, Conn.
Whitney Chain & Mfg. Co., The, Bartholomew Ave., Hartford, Conn.
Whitney Mfg. Co., W. A., 636 Race St., Rockford, Ill.
●Whitney Metal Tool Co., 110 Forbes St., Rockford, Ill.
Wickes Boiler Co., 502 N. Water St., Saginaw, Mich.
Wickwire Spencer Steel Co., 41 E. 42nd St., New York, N. Y.
Wiedemann Machine Co., 1815 Sedgley Ave., Philadelphia, Pa.
●Wiegand Co., Edwin L., 7610 Thomas Blvd., Pittsburgh, Pa.
Wilcolator Co., 17 Nevada St., Newark, N. J.
Will-Burt Co., Orrville, O.
●Williams & Co., J. H., 264 Spring St., New York, N. Y.
Williams & Son, I. B., Dover, N. H.
Williams Gauge Co., 1620 Pennsylvania Ave., N. S., Pittsburgh, Pa.
Williams, Inc., F. C., 22805 Michigan Ave., Dearborn, Mich.
Williams Oil-O-Matic Heating Corp., 1201 East Bell, Bloomington, Ill.
Williams Valve Co., D. T., Spring Grove Ave. & Township Street, Cincinnati, O.
Willson Products, Inc., 348 Thorn St., Reading, Pa.
Will-Weld Mfg. Co., Inc., 1501 Jackson St., Omaha, Nebr.
Wilson & Co., 4100 S. Ashland Ave., Chicago, Ill.
Wilson Co., H. A., 97 Chestnut St., Newark, N. J.
●Wilson, Inc., Grant, 4115 W. Taylor St., Chicago, Ill.
Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York, N. Y.
Winchester Repeating Arms Co., 275 Winchester Ave., New Haven, Conn.
●Wing Mfg. Co., L. J., 14th St. & 7th Ave., New York, N. Y.
Wiss & Sons Co., J., 33 Littleton Ave., Newark, N. J.
Wittenmeier Machinery Co., 850-860 N. Spaulding Ave., Chicago, Ill.
Wolff & Munier, Inc., 222 E. 41st St., New York, N. Y.
Wolverine Tube Co., 1455 Central Ave., Detroit, Mich.
Wood Conversion Co., 1981 First National Bank Bldg., St. Paul, Minn.
Wood Industries, Inc., Gar, 7924 Riopelle St., Detroit, Mich.
Wood's Sons Co., T. B., 1275 Fifth Ave., Chambersburg, Pa.
Worthington-Gamon Meter Co., Harrison, N. J.
●Worthington Pump & Machinery Corp., Harrison, N. J.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
Wright-Austin Co., 315 W. Woodbridge St., Detroit, Mich.
Wyckoff & Son Co., A., 100 Home St., Elmira, N. Y.

X

X Laboratories, 25 W. 45th St., New York, N. Y.
X L Refrigerating Co., 1834 W. 59th St., Chicago, Ill.
X-Pando Corp., 4315 Thirty-Sixth St., Long Island City, N. Y.

Y

Yale & Towne Mfg. Co., Stamford, Conn.
Yardley Screen & Weather Strip Co., 142 Parsons Ave., Columbus, O.
●Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.
Yates-American Machine Co., Beloit, Wis.
Yeomans Bros. Co., 1433 N. Dayton St., Chicago, Ill.
Yoder Co., 5500 Walworth Ave., Cleveland, O.
●York Ice Machinery Corp., Roosevelt Ave., York, Pa.
York Oil Burner Co., Inc., P. R. R. & Jessup Pl., York, Pa.
Yost Mfg. Co., Meadville, Pa.
●Young Radiator Co., 709 Mead St., Racine, Wis.
Young Regulator Co., 4500 Euclid Ave., Cleveland, O.
Youngstown Pressed Steel Co., Warren, O.
Youngstown Sheet & Tube Co., 602 Stambaugh Bldg., Youngstown, O.

Z

Zapon-Brevolite Div., Atlas Powder Co., North Chicago, Ill.
Zeh & Hahnemann Co., 182-200 Vanderpool St., Newark, N. J.
Zobell Electric Motor Corp., 96 South Ave., Garwood, N. J.
Zonolite Co., The, 5905 Second Blvd., Detroit, Mich.

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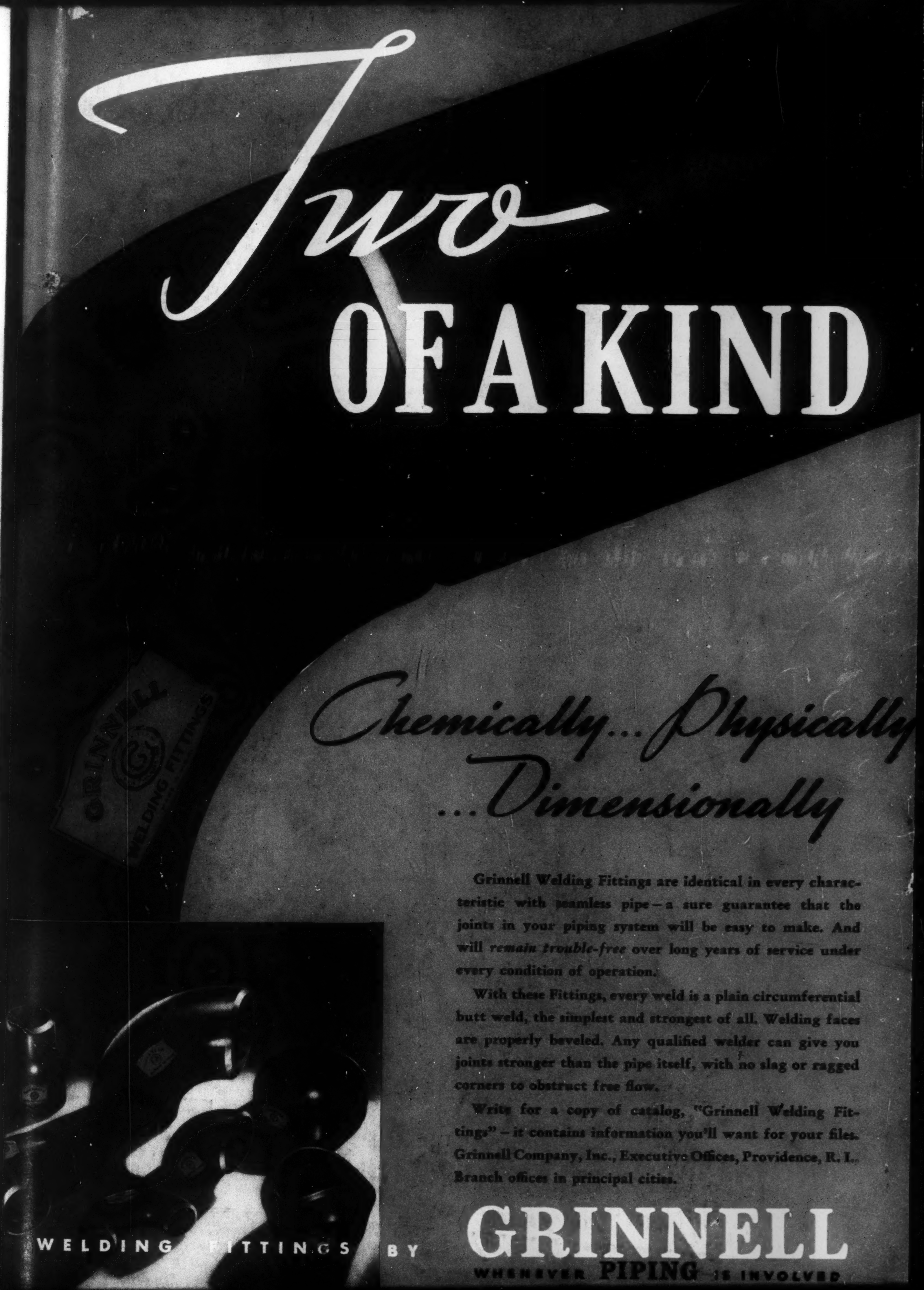

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